

Climate Change and Oregon

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Oregon Hatchery Research Council
Advisory Board
Newport, OR | March 12, 2012

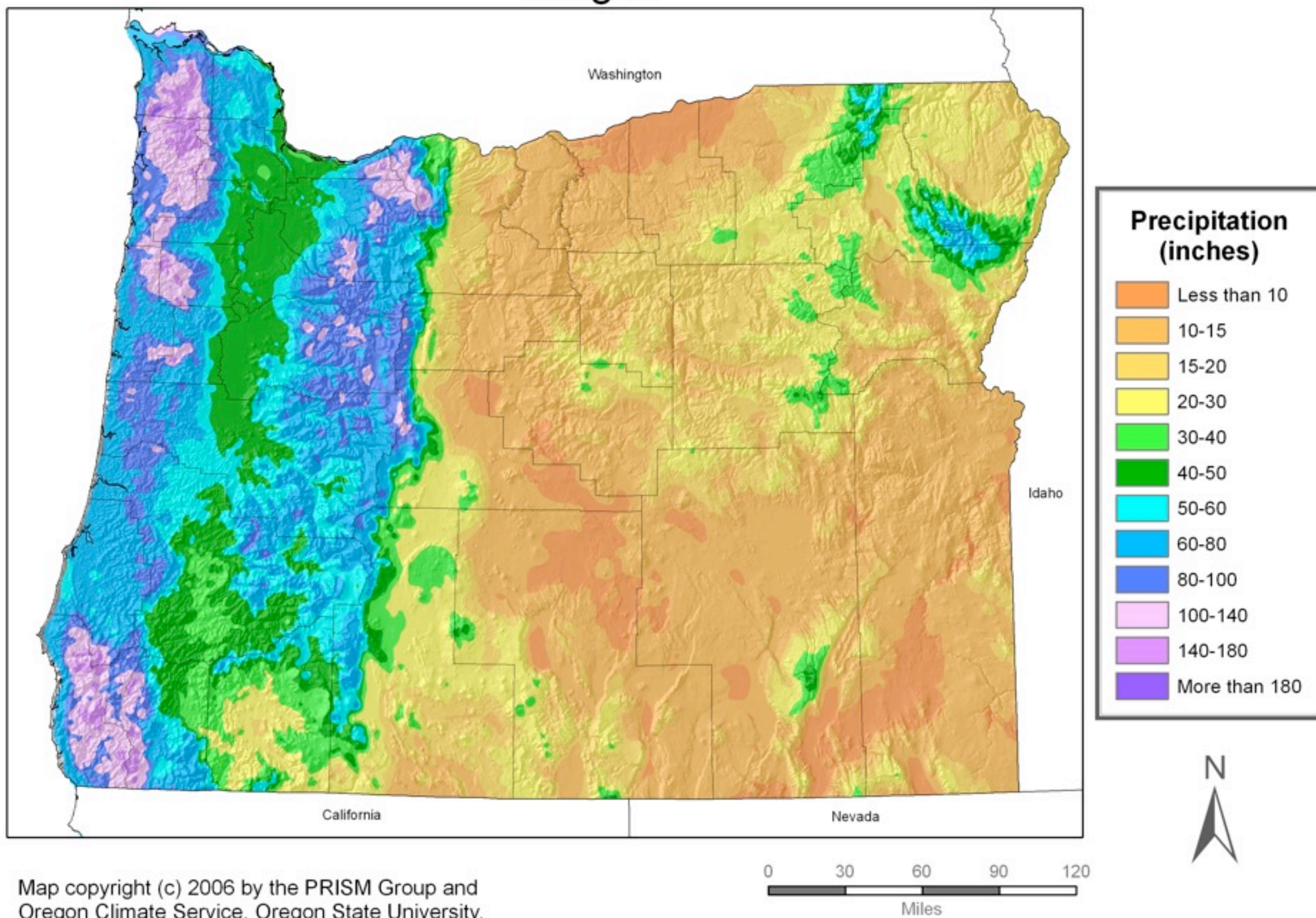
photo credit: Daniel Brown



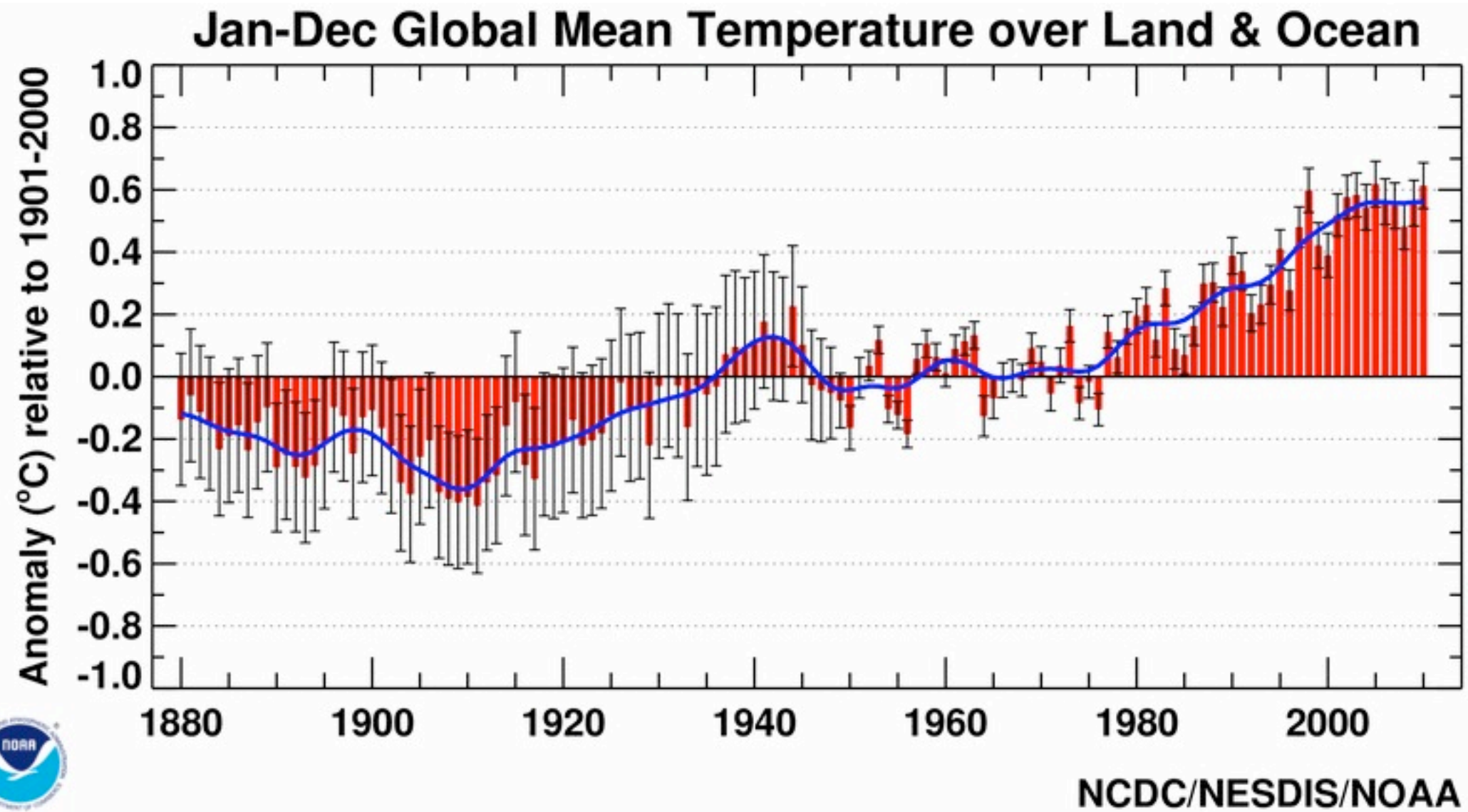
Oregon's climate knowledge network

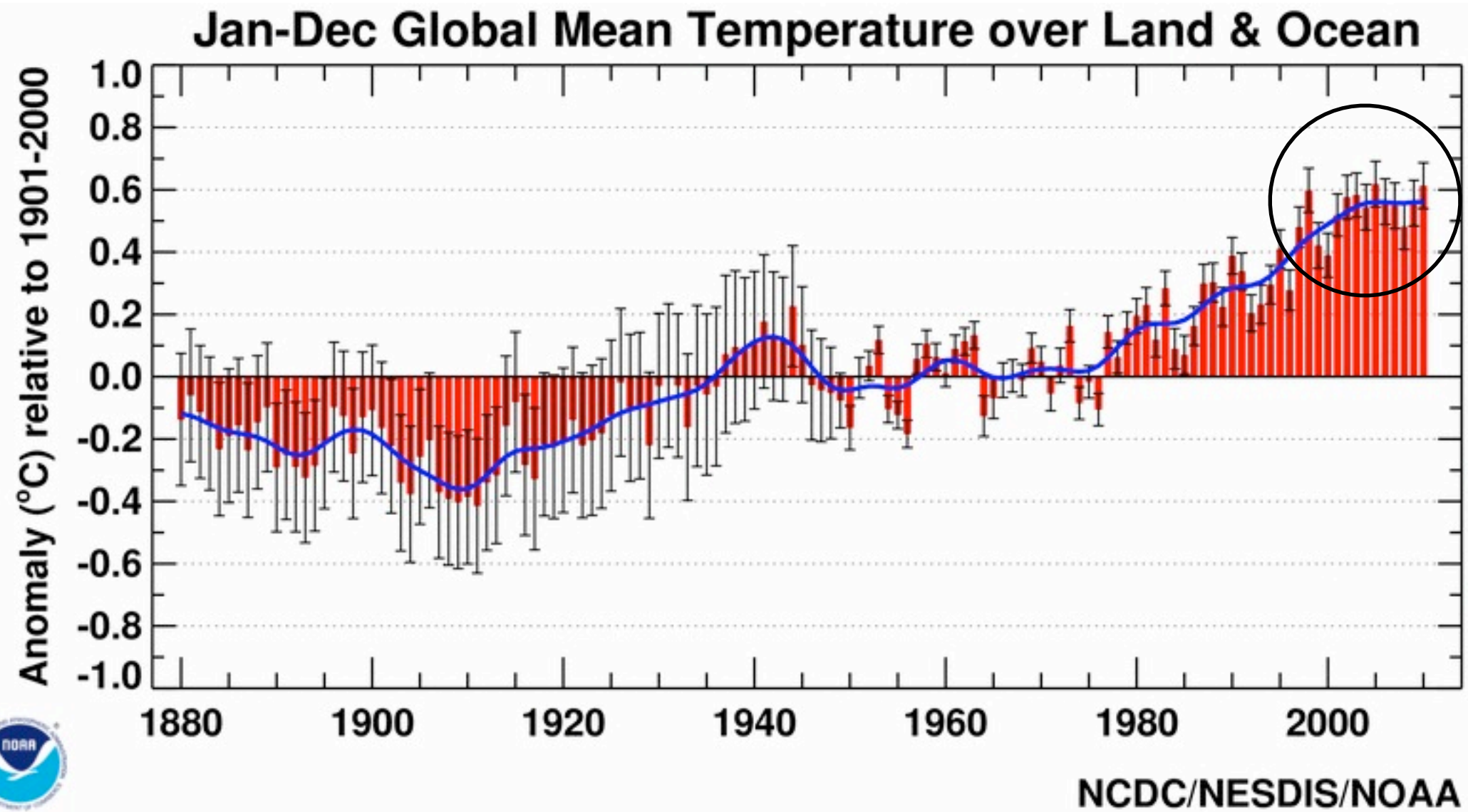
- ❖ Oregon Climate Change Research Institute (HB 3543)
- ❖ Oregon Climate Service (ARSCO state climate office)
- ❖ Climate Impacts Research Consortium (CIRC)
 - ❖ NOAA-funded Regional Integrated Sciences and Assessment
- ❖ NW Department of Interior Climate Science Center

Average Annual Precipitation, 1971-2000 Oregon

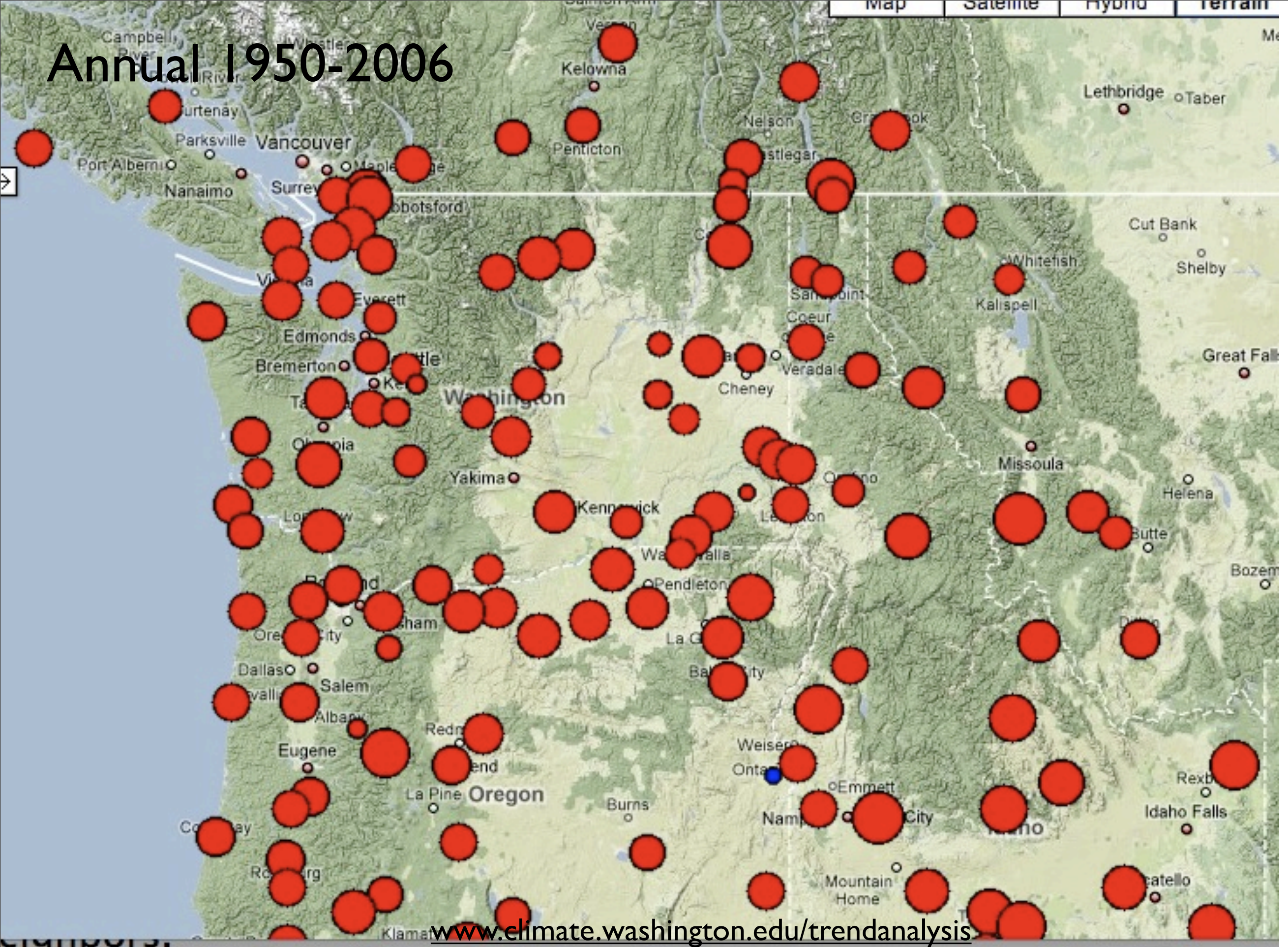


Daly et al. 1994, 2007, www.prism.oregonstate.edu

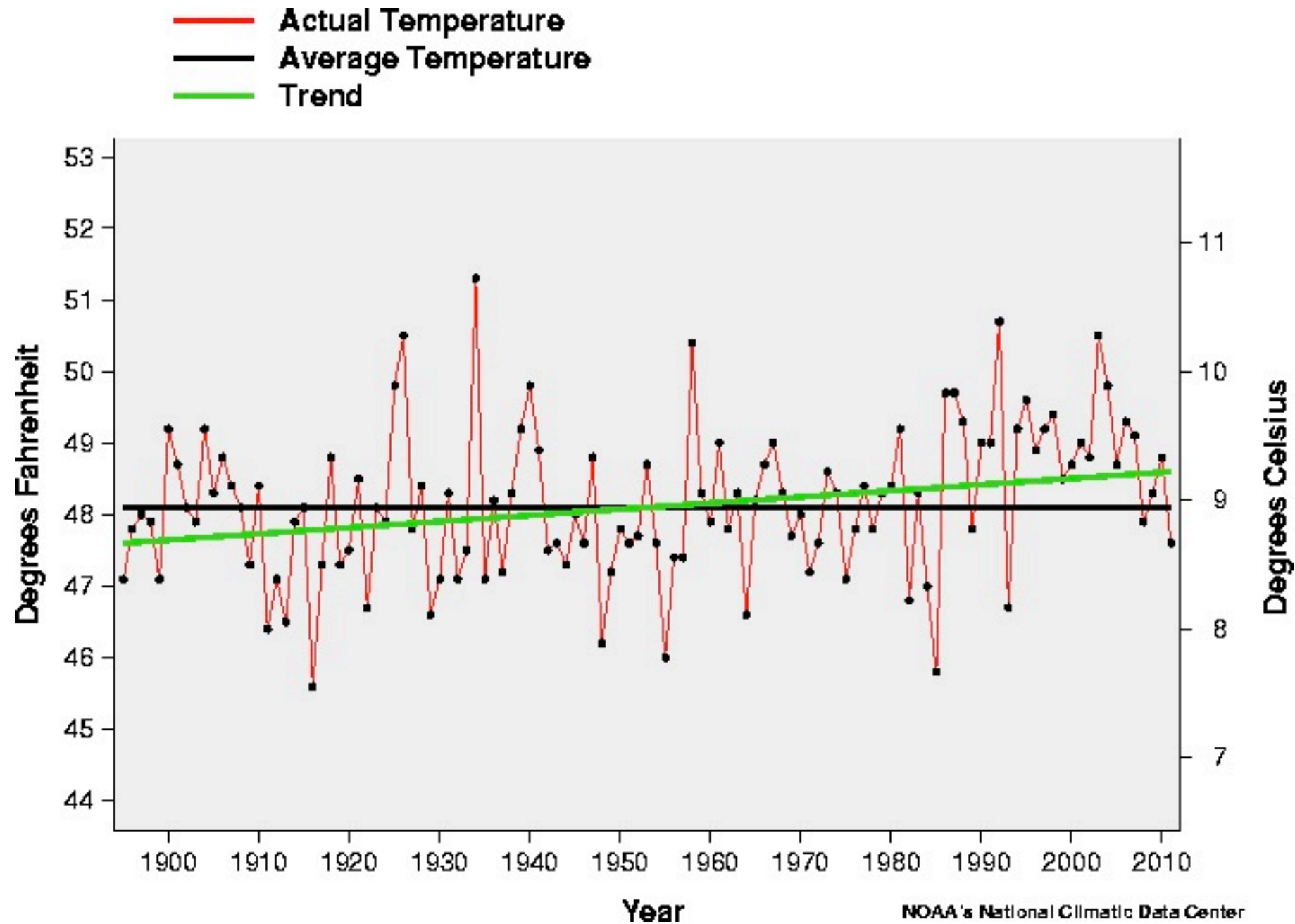




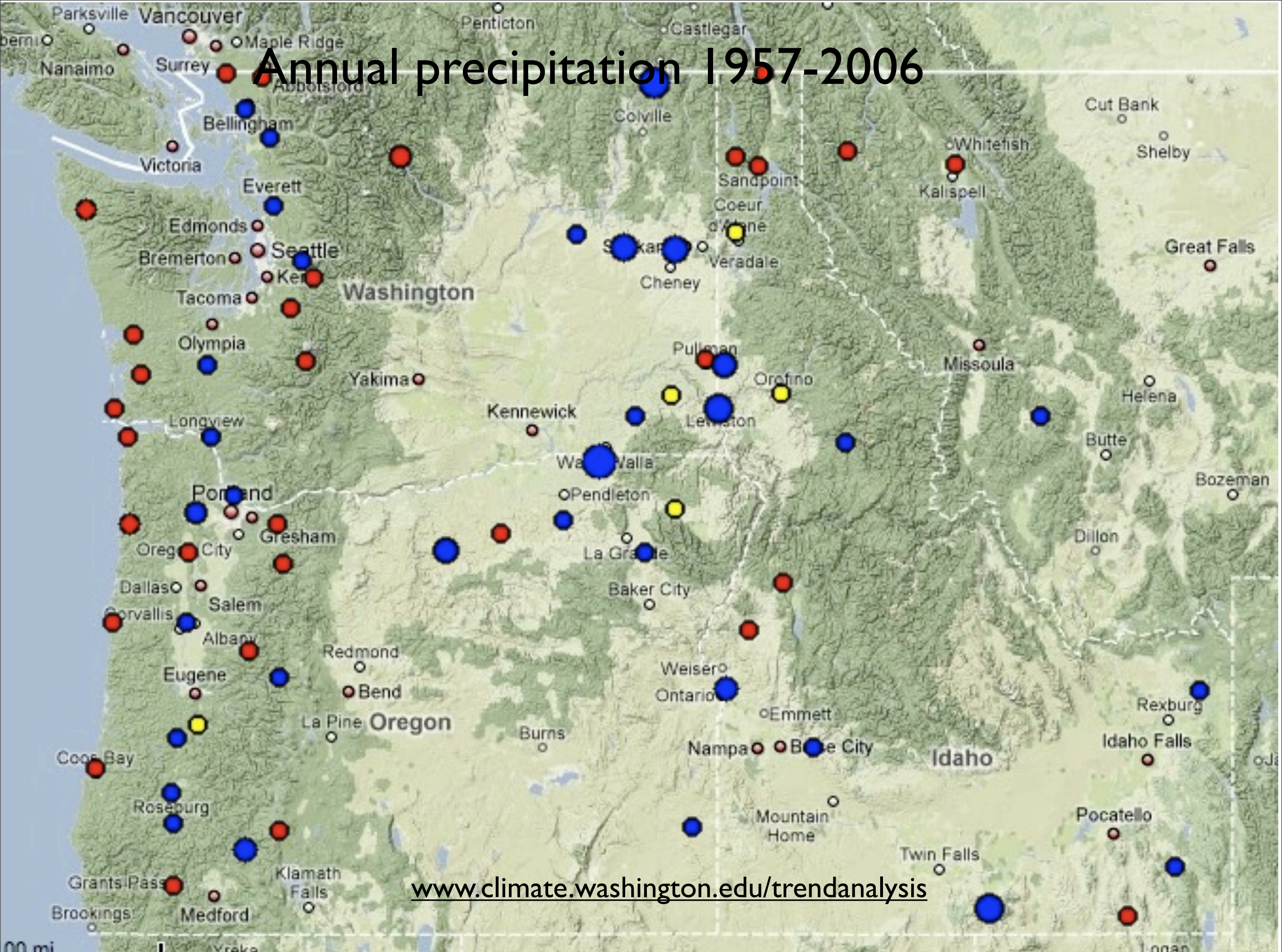
Annual 1950-2006



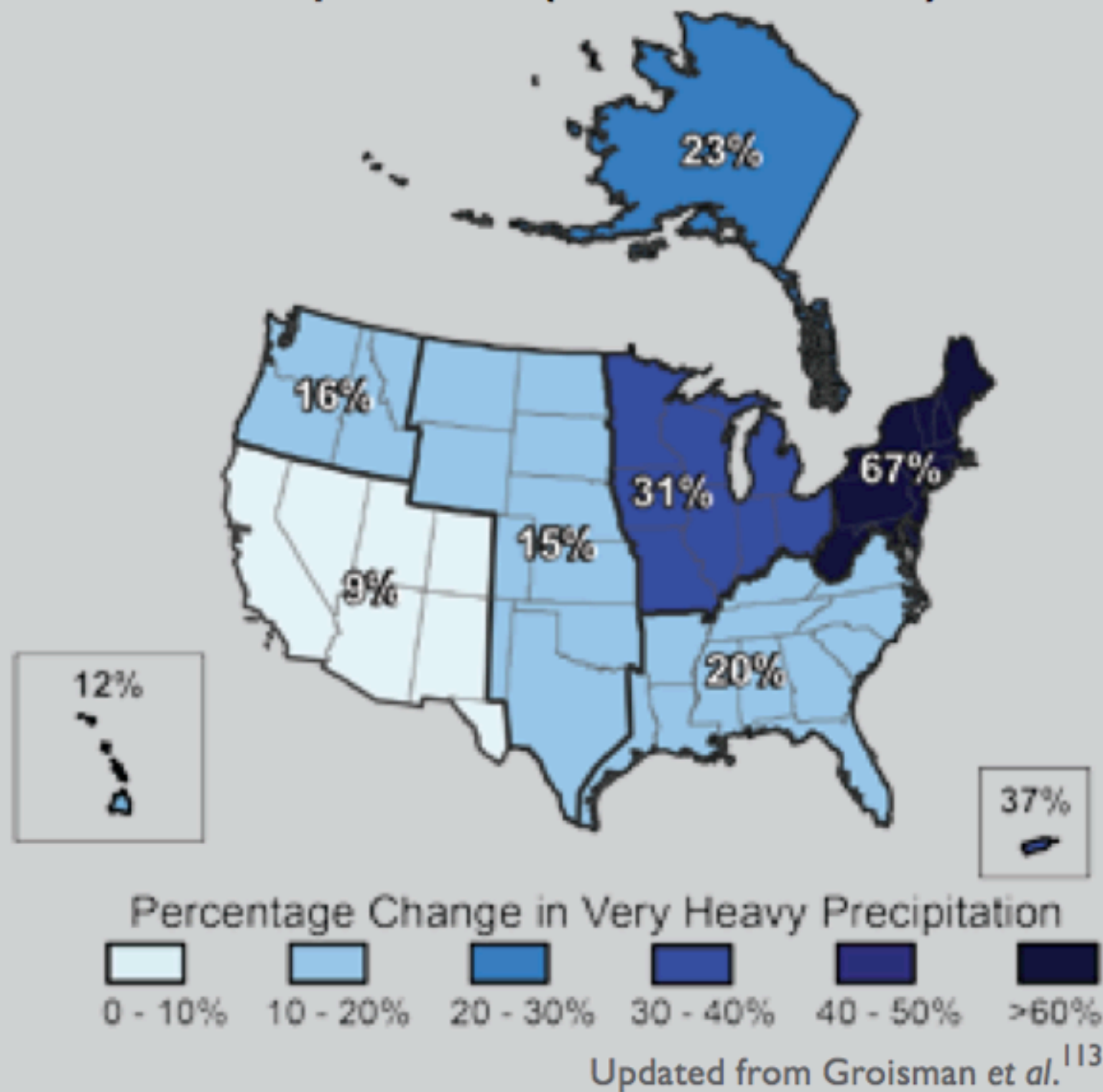
Oregon annual historical temperature trend



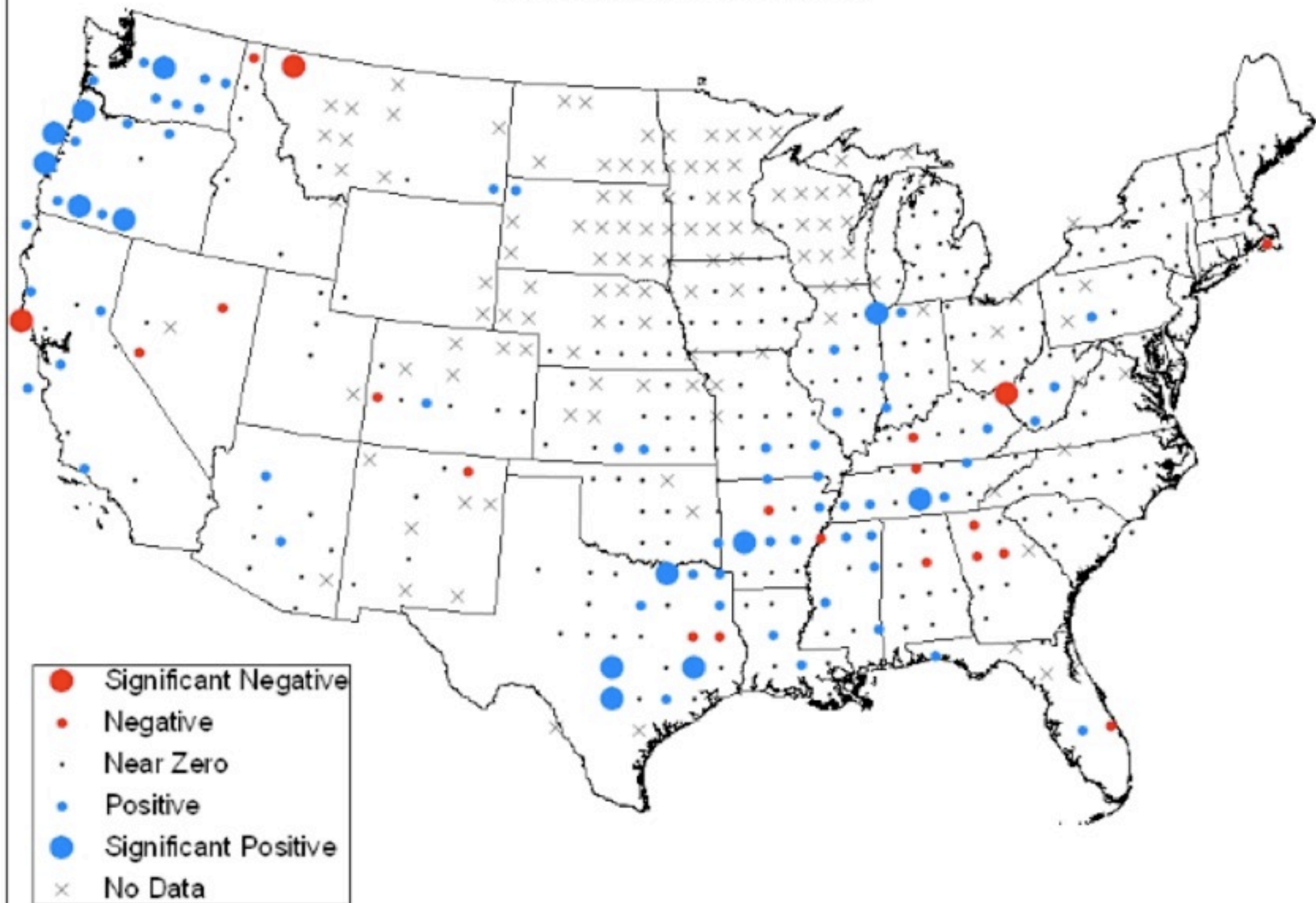
Annual precipitation 1957-2006



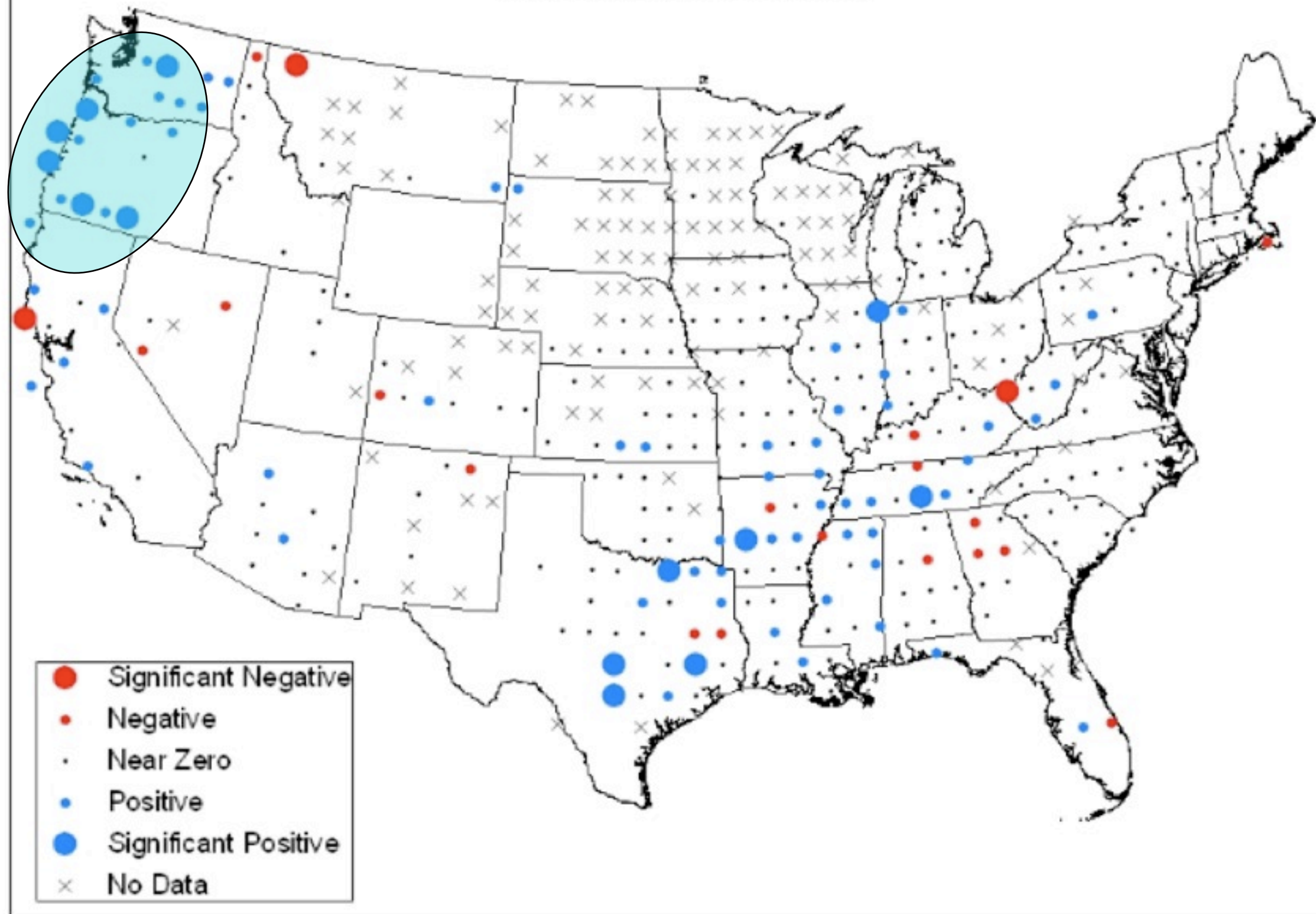
Increases in Amounts of Very Heavy Precipitation (1958 to 2007)



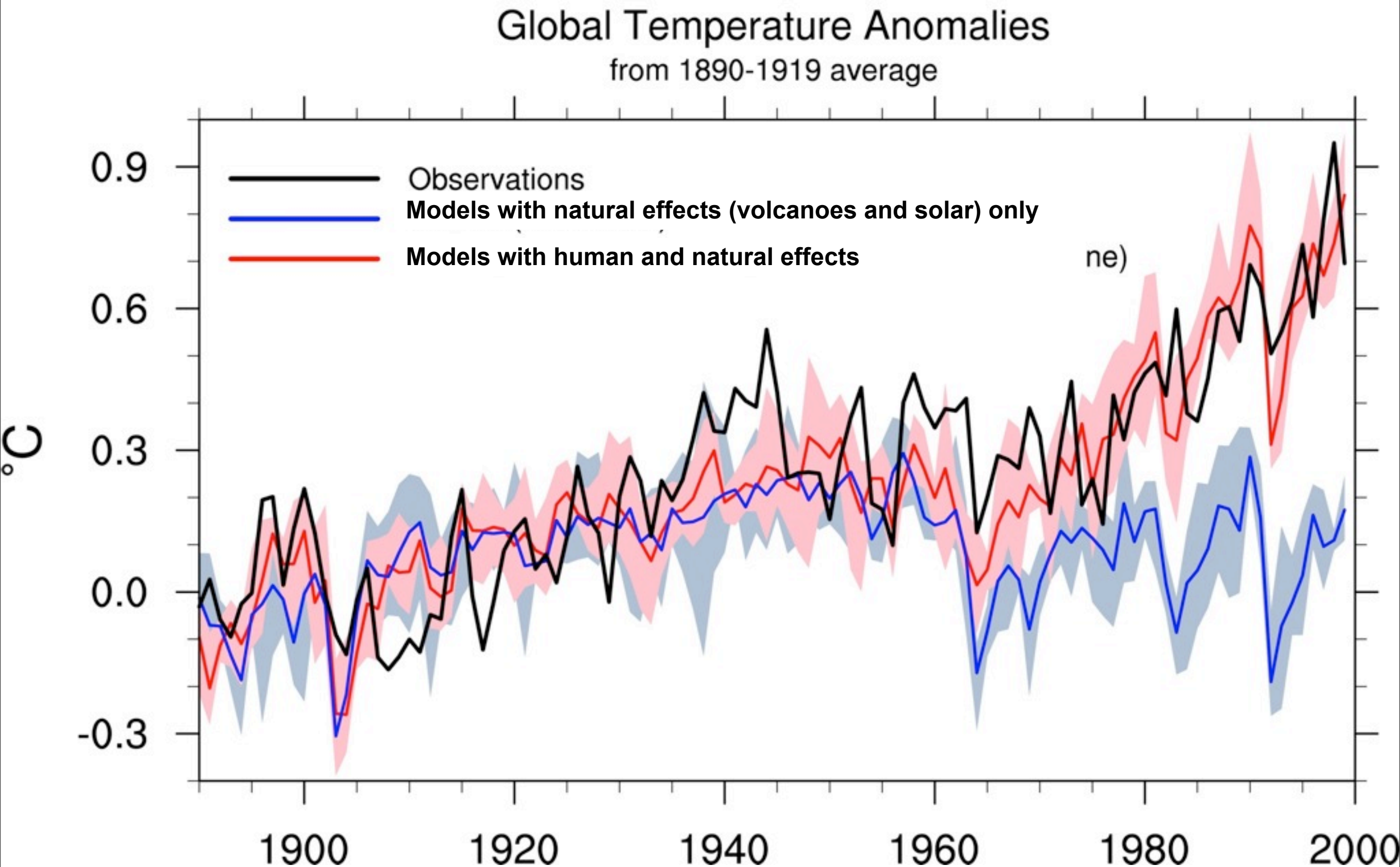
November-December



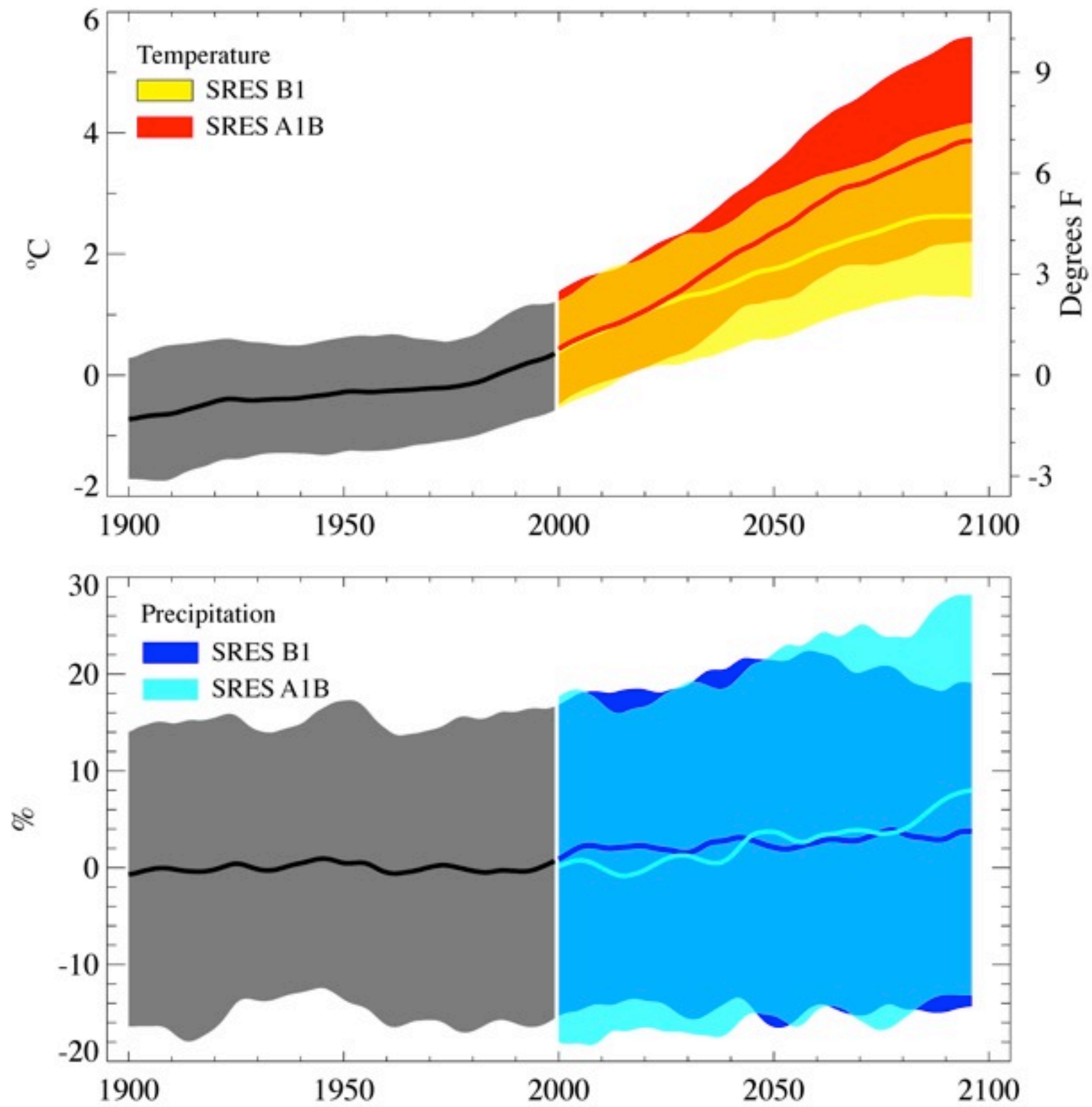
November-December



Climate models: Natural processes do not account for observed 20th century warming after 1965



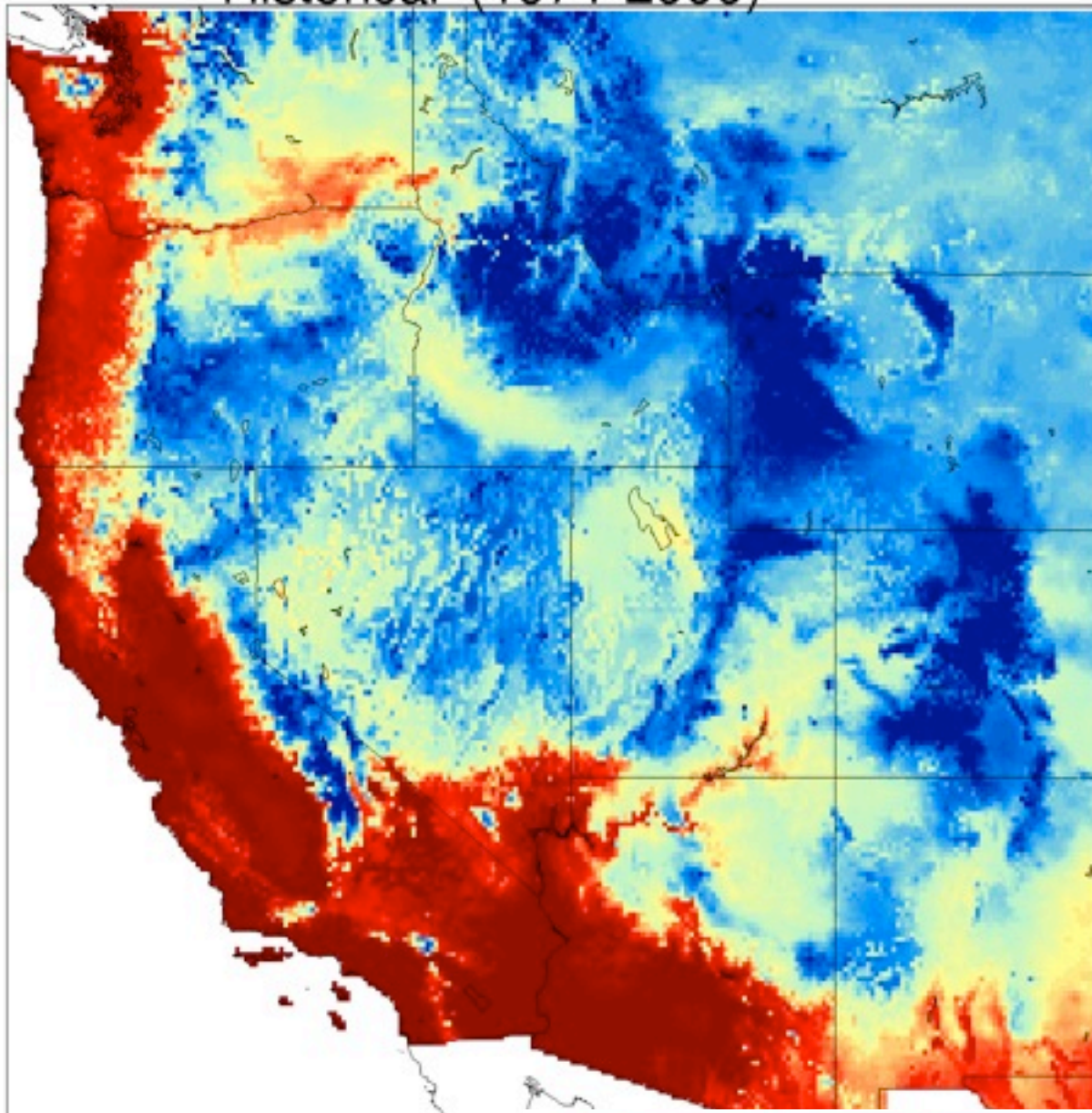
Ch. I



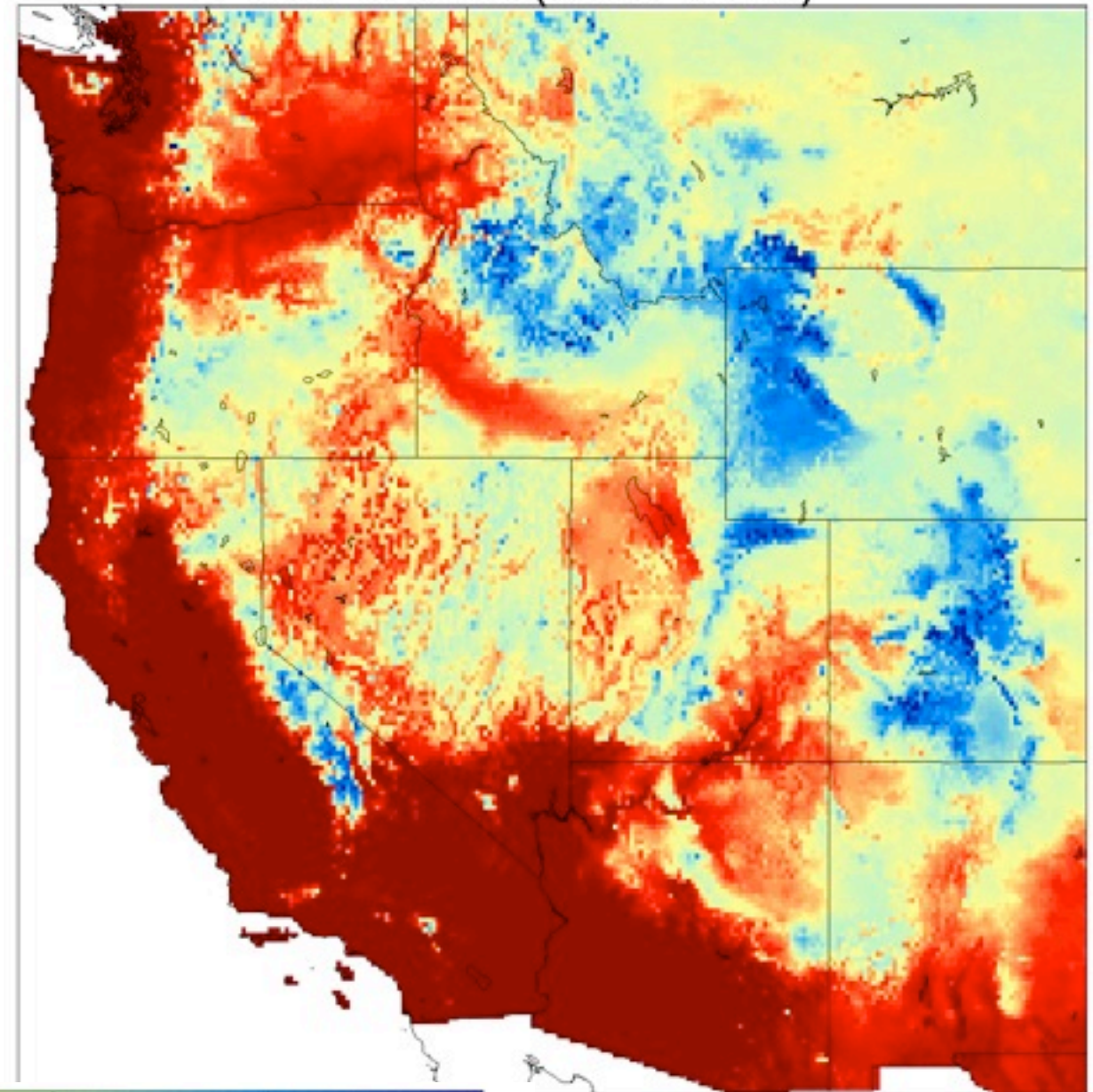
Mote and Salathé, 2010

Projections: Fewer Cold Nights

Days per Year $T_{min} \leq 0^{\circ}\text{C}$
Historical (1971-2000)

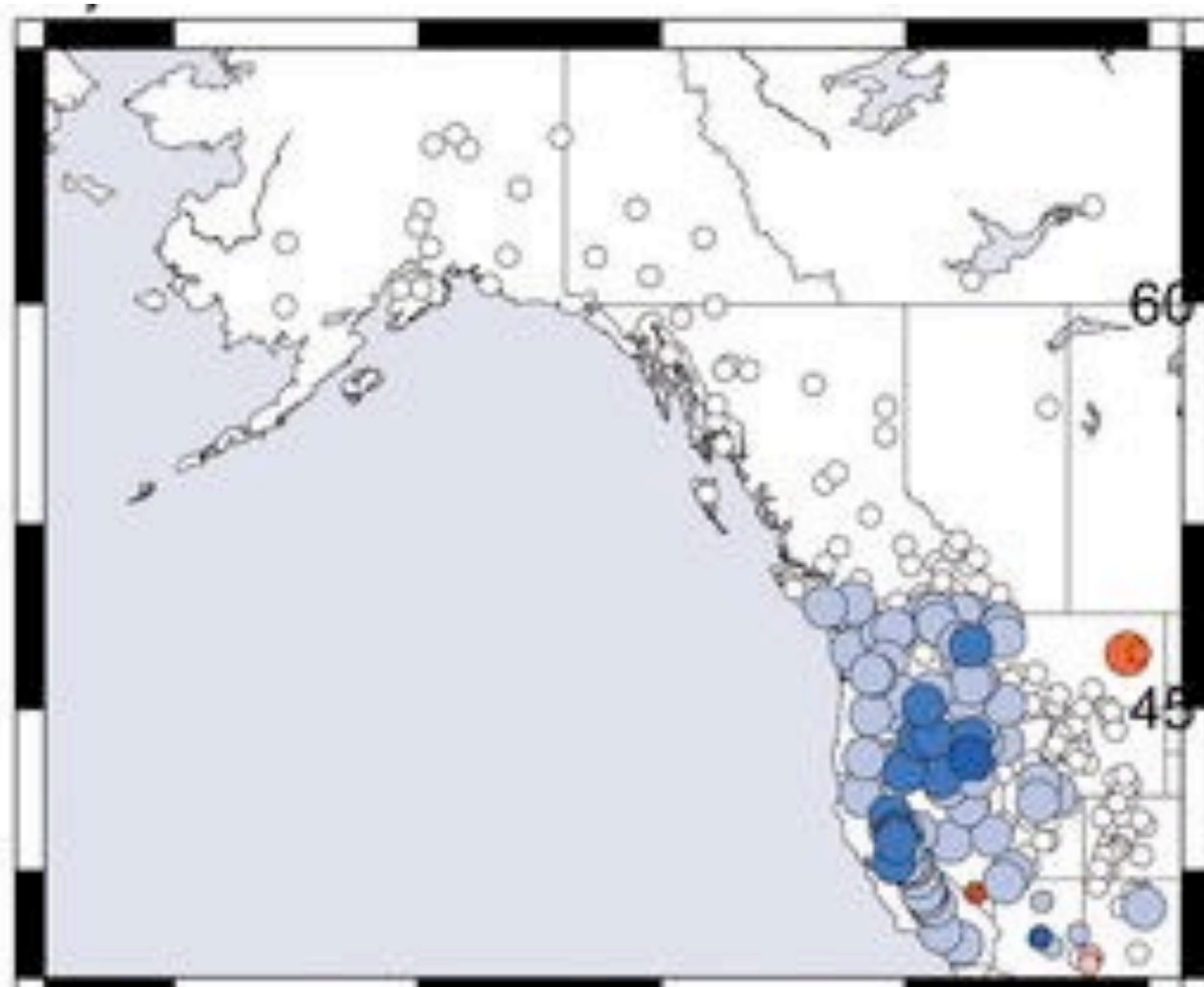


Days per Year $T_{min} \leq 0^{\circ}\text{C}$
SRES-A1B (2081-2100)

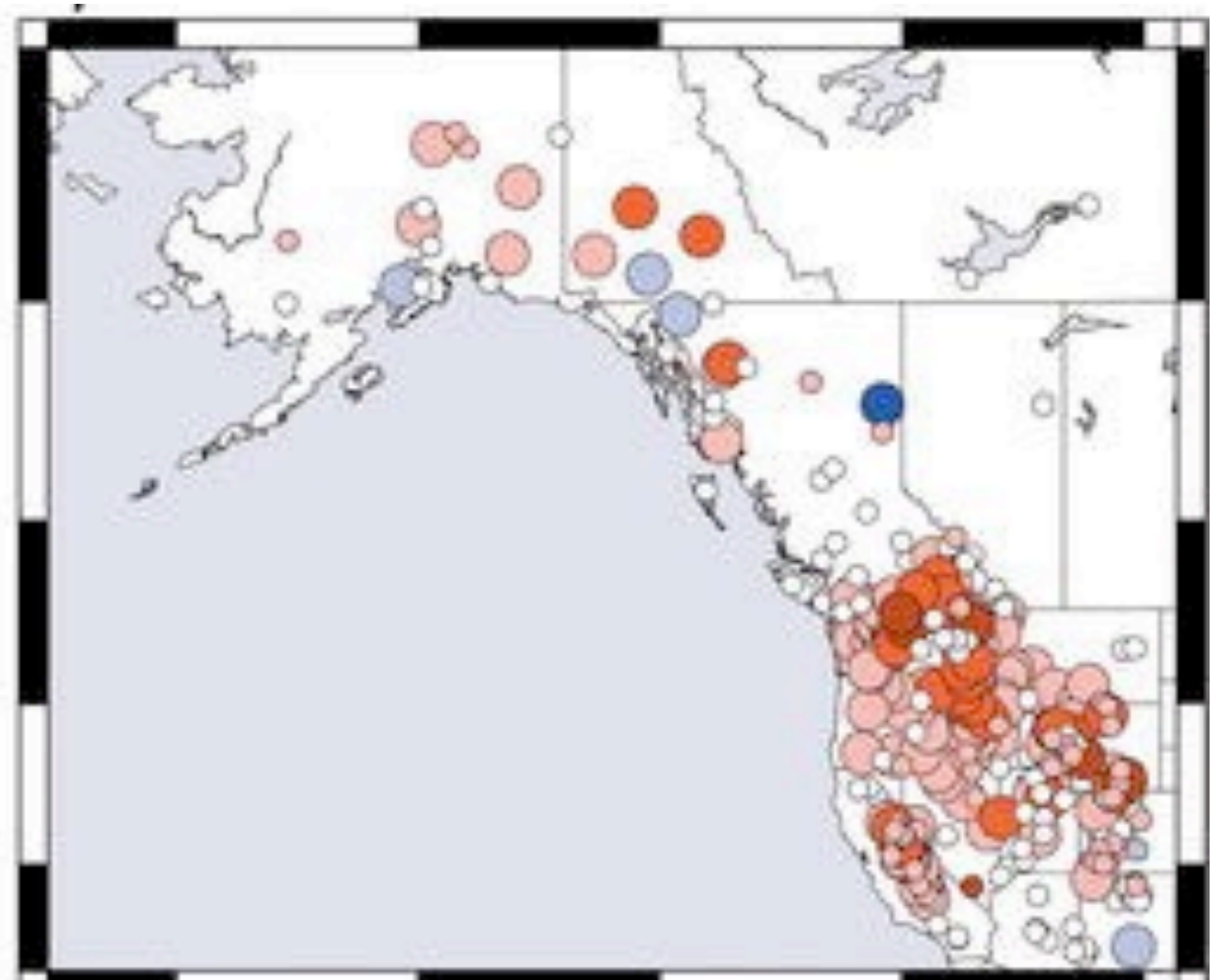


Trends in historical stream flow 1948–2002

March Fractional Flow



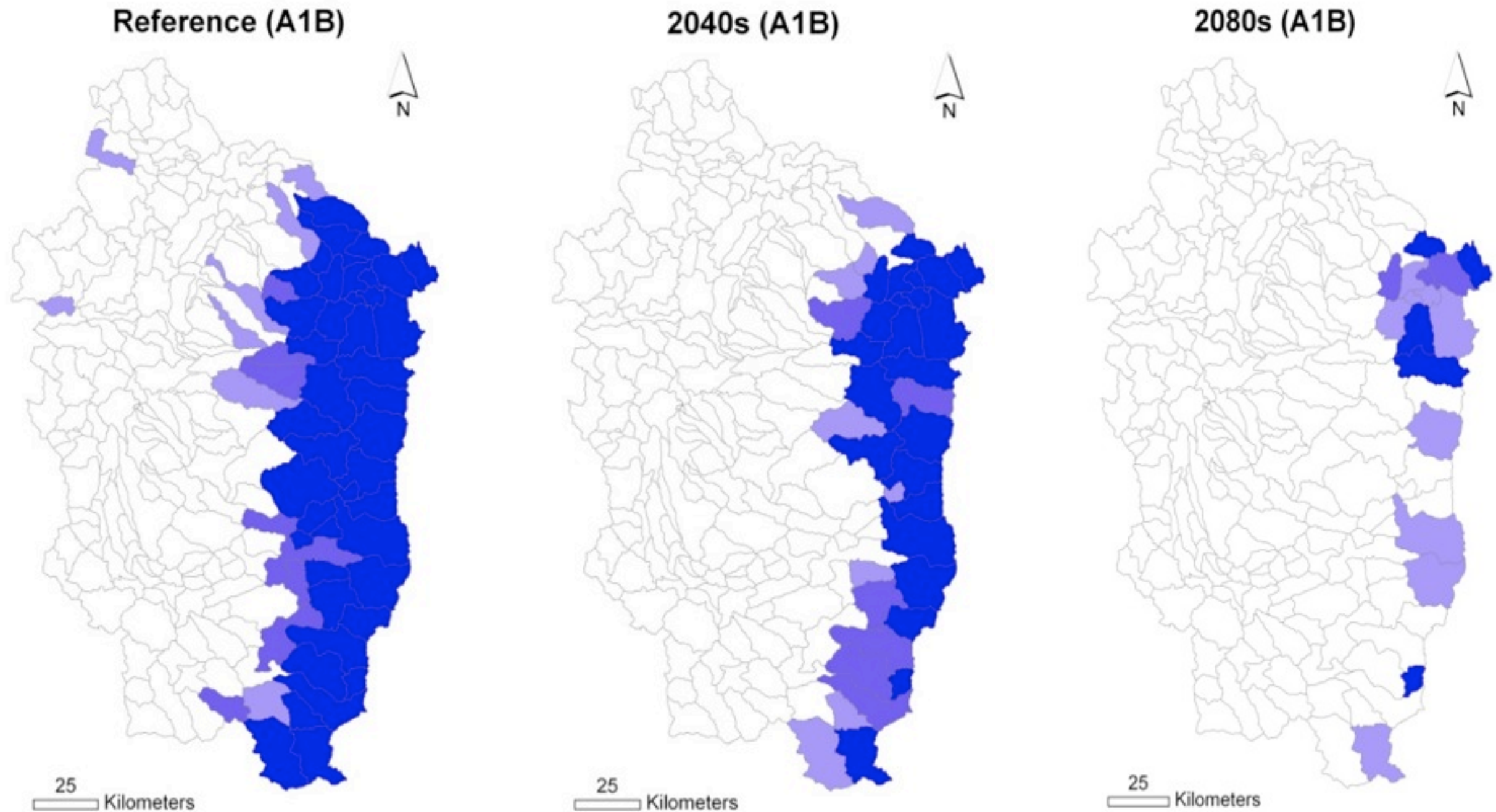
June Fractional Flow



Stewart et al, 2004, Journal of Climate

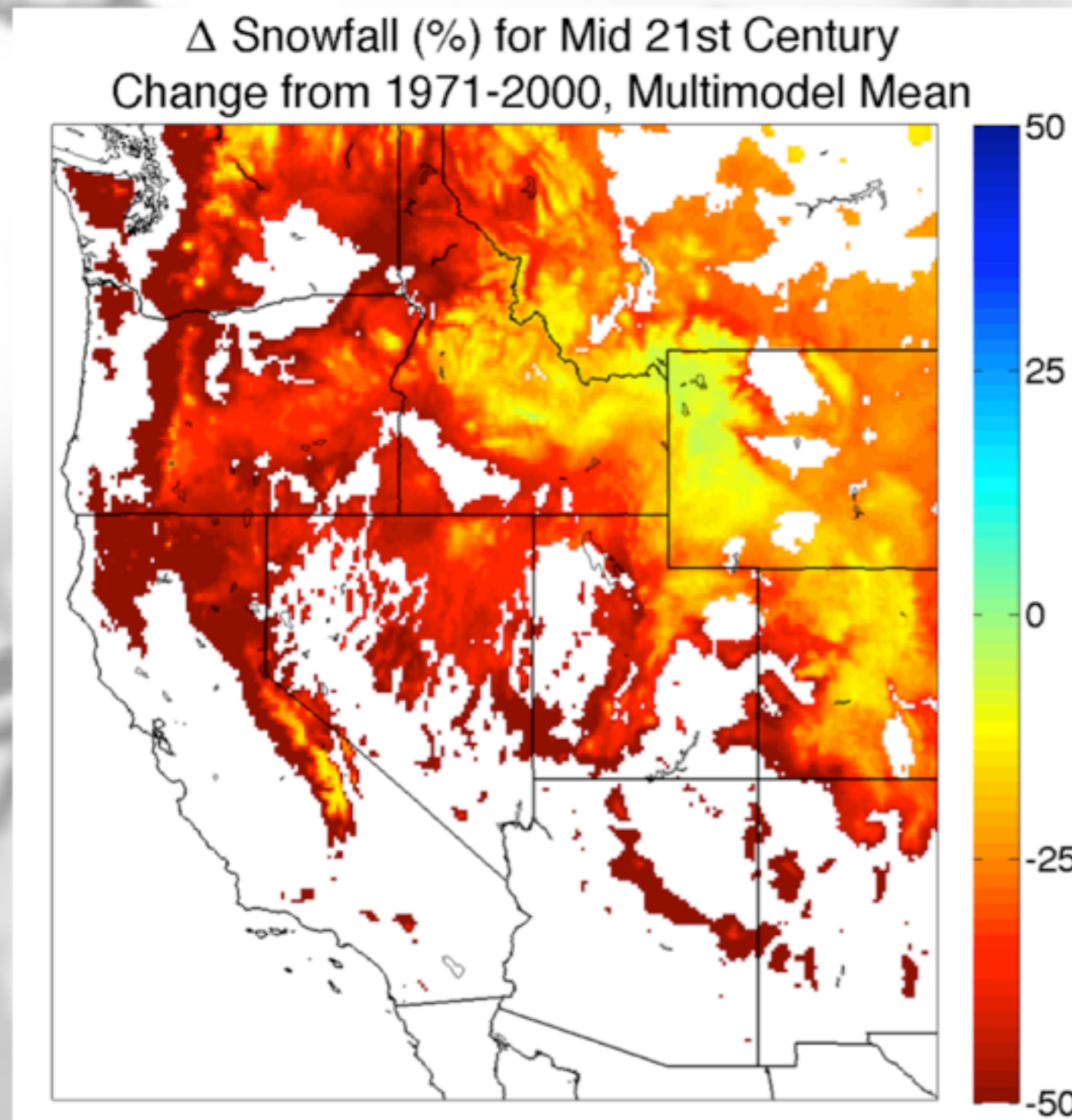
Ch. 3

April 1 snow water equivalent in Willamette Basin

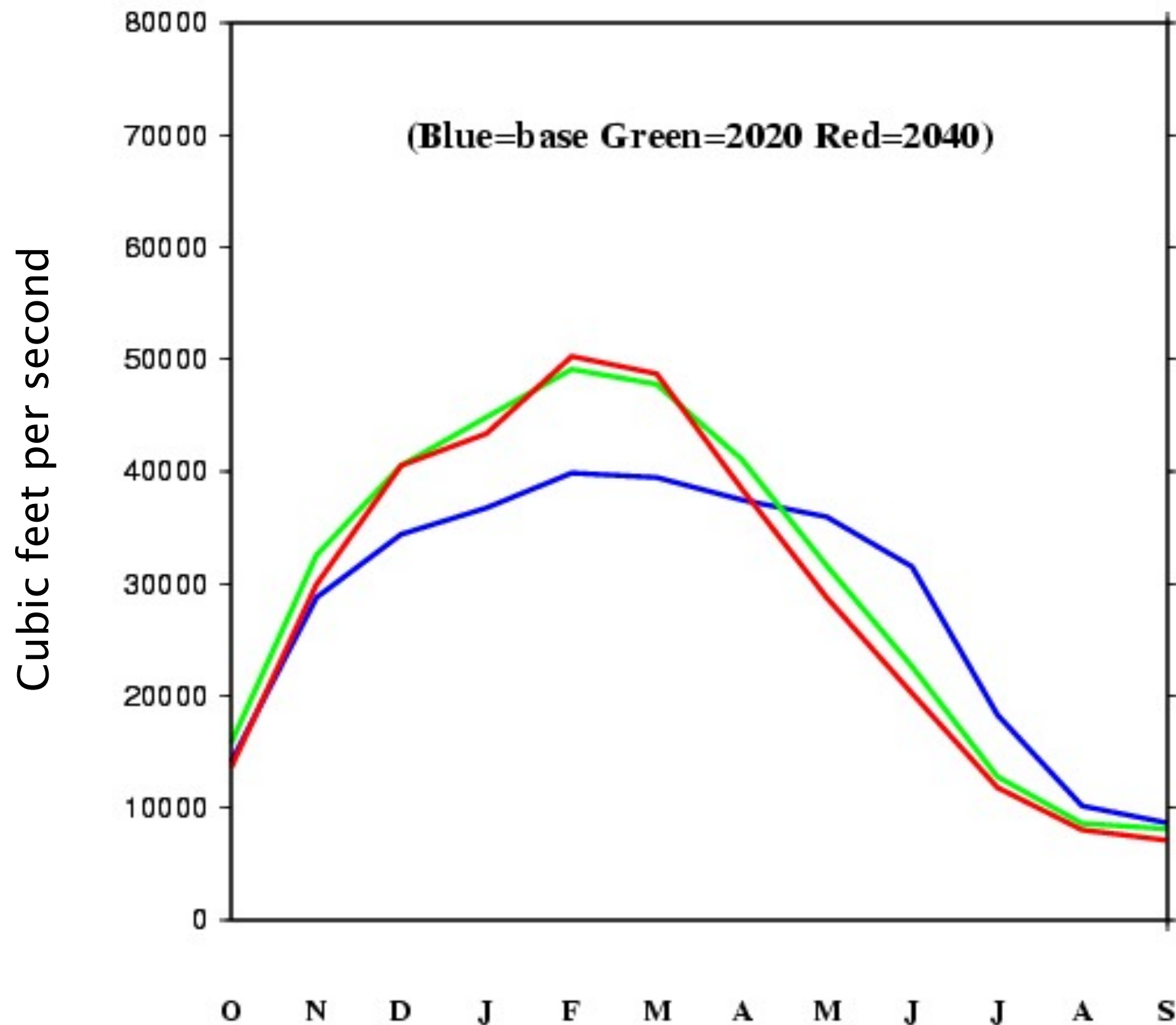


Chang and Jung 2010

Projections: Less Mountain Snowpack



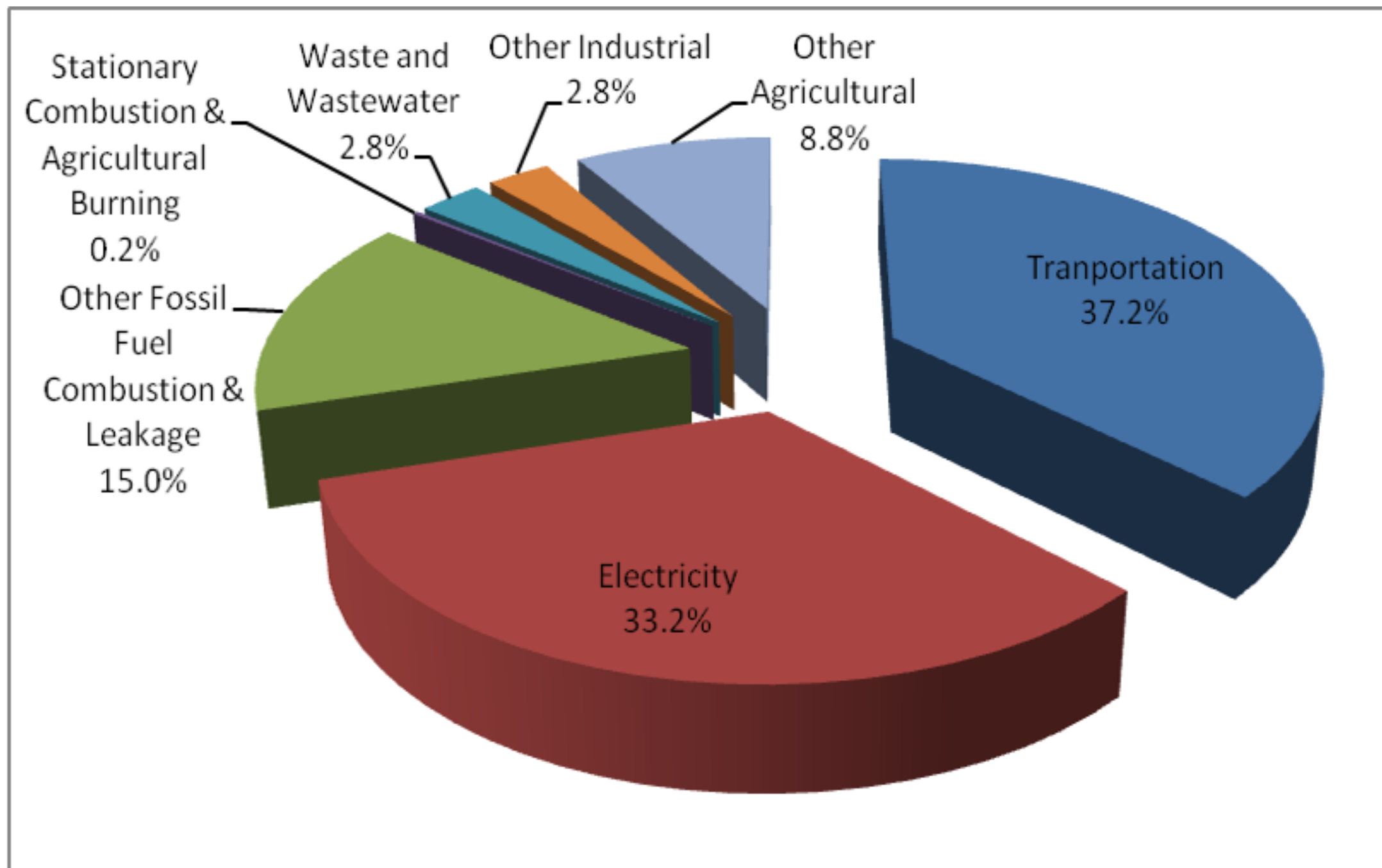
Simulated Natural Flow in the Willamette River at the Columbia



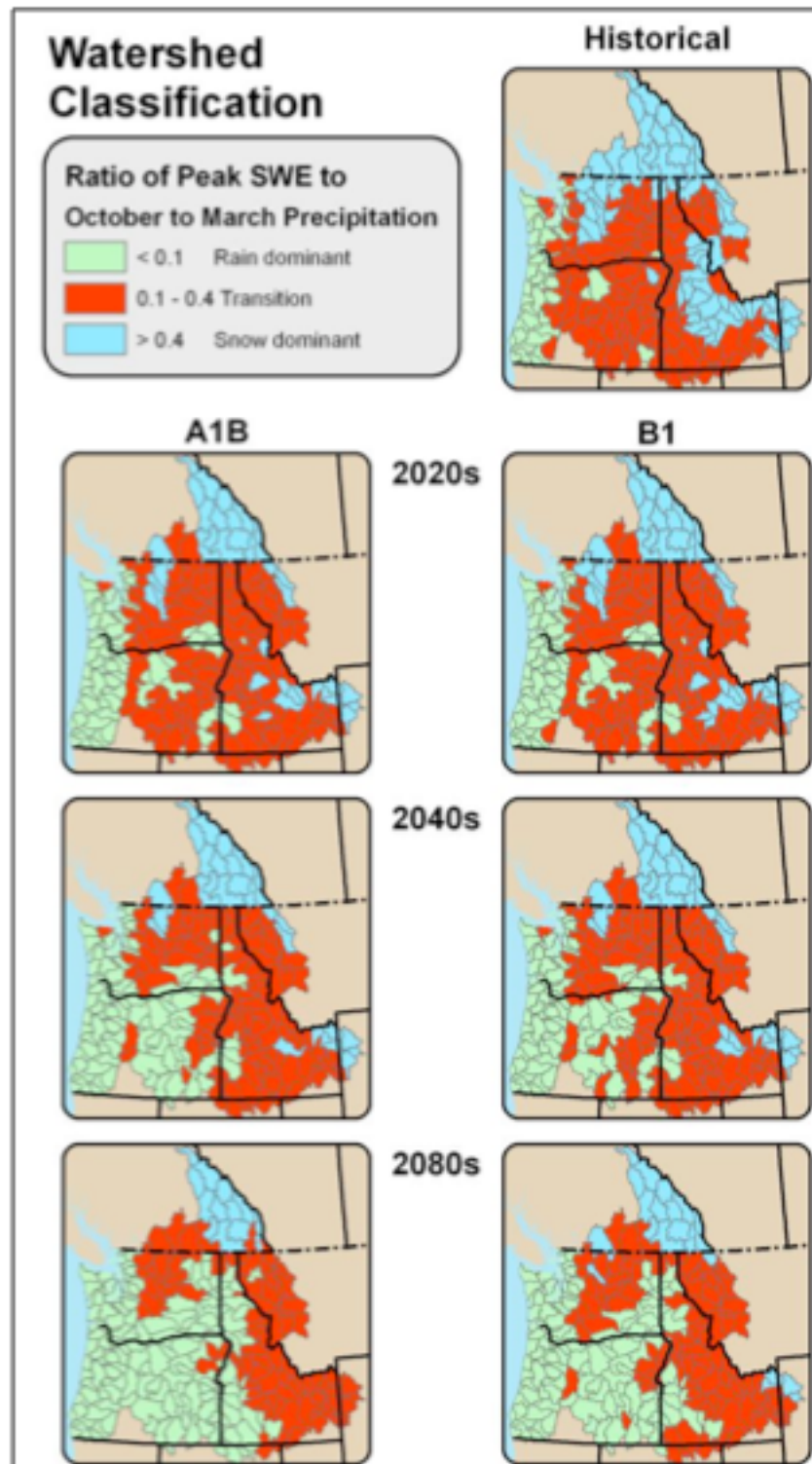
Modeling: Alan Hamlet

Seasonal changes

- Changes in precipitation equivocal fall, winter, spring
- More warming (and drier) in summer
- Likelihood of more extreme precipitation



Oregon Greenhouse Gas Inventory, 2010

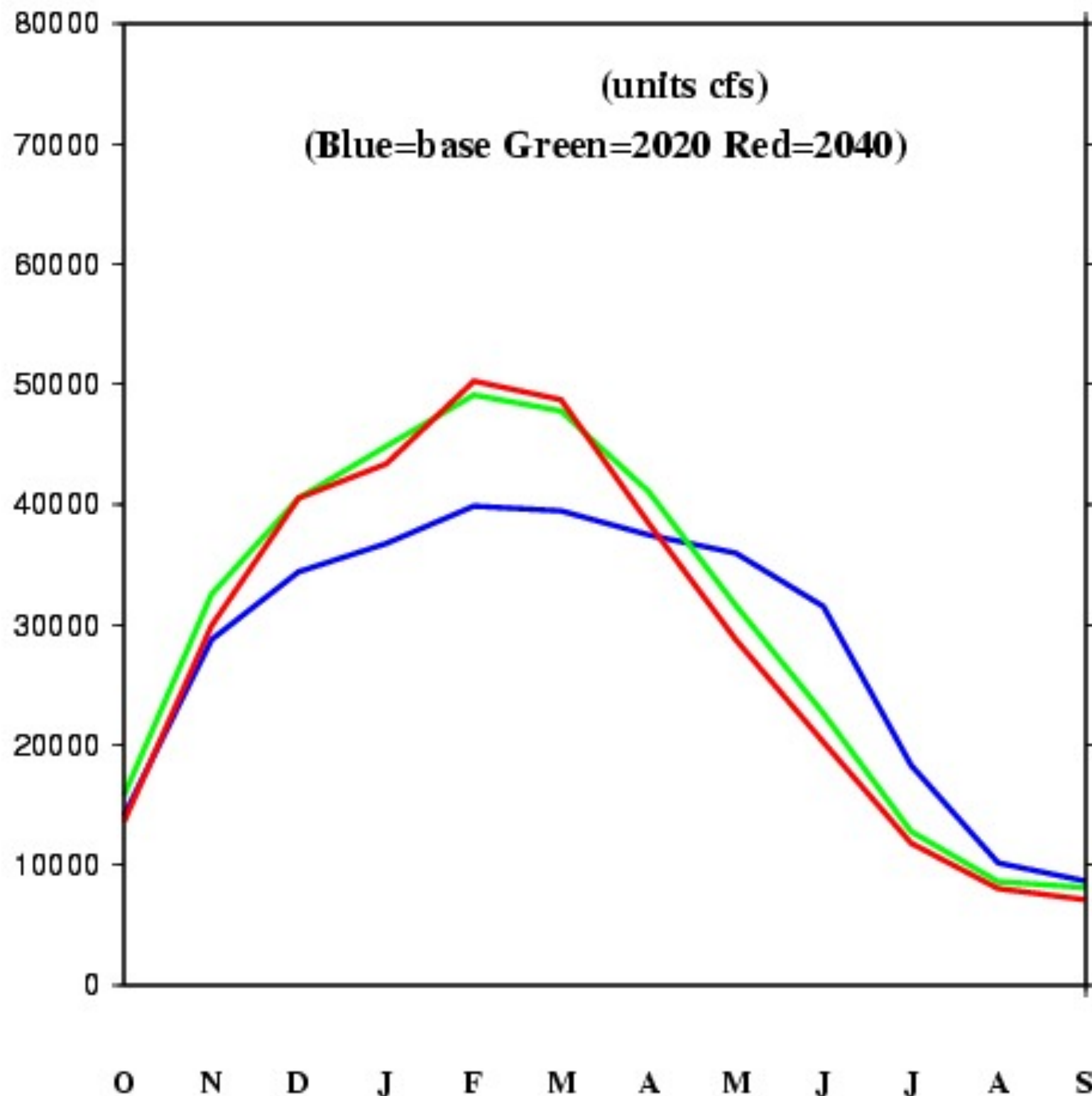


- many basins becoming rain dominant in OR by 2080
- almost no snow dominant basins projected by end of century in PNW (CONUS)

Tohver and Hamlet, 2010

Ch. 3

Simulated Natural Flow in the Willamette River at the Columbia



Modeling: Alan Hamlet
Analysis: Kathie Dello

Impacts: Agriculture

5+ billion dollar business, vast majority relies on heavy irrigation

Pros (for some crops)

- Increased growing season length
- Potential Increase in yields
- New crops (vineyards)
- Higher CO₂ stimulate plant growth/water efficiency

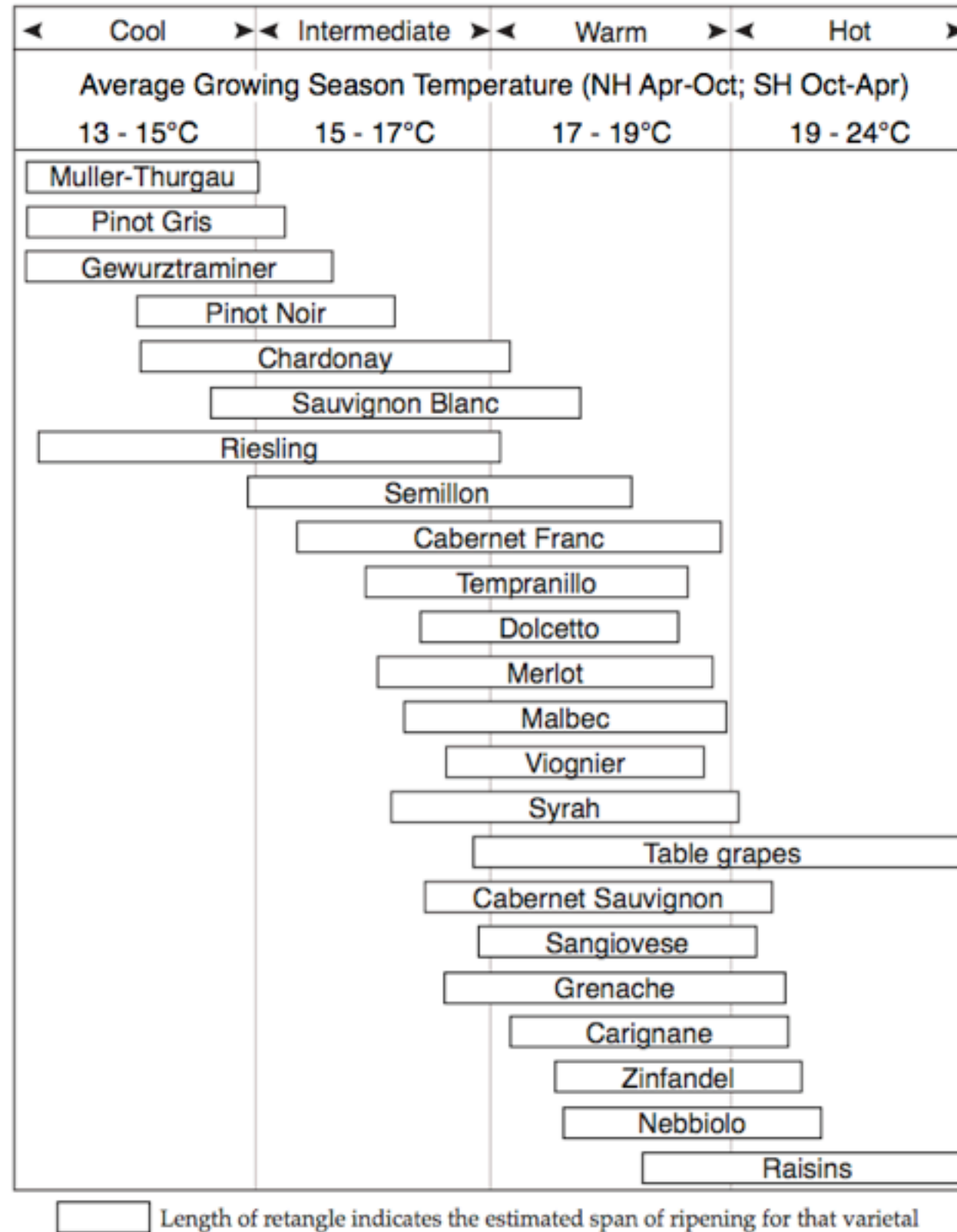
Cons

- Increased irrigation demands*
- Increases in summer temperatures impact dairy industry

agriculture in OR

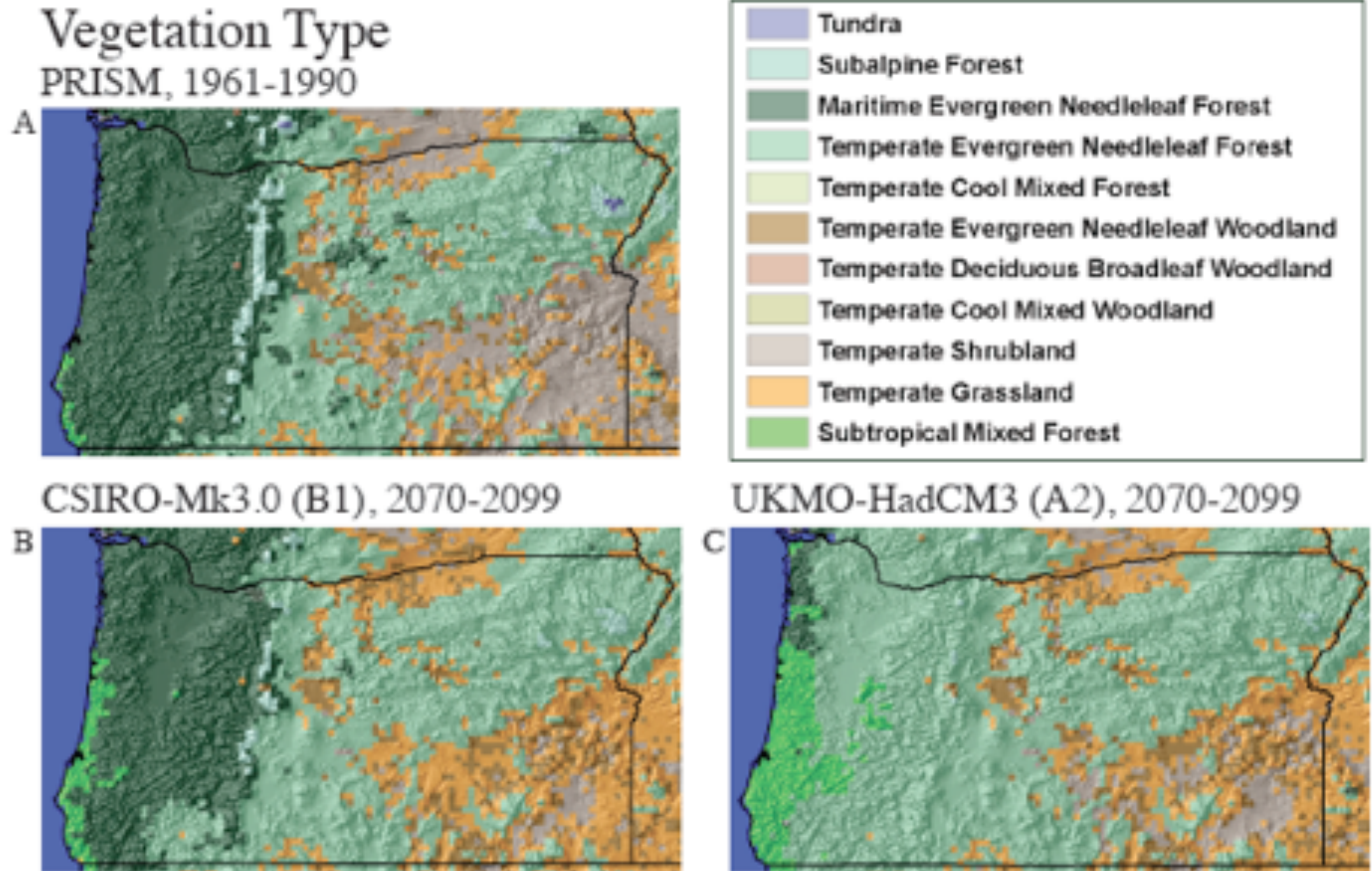
- state is top producer of 15 US commodities
- agriculture makes up about 9% of OR ghg emissions
- Concerns: availability of water; weeds, insects
- Plus: longer growing season, more wine varieties

Grapevine Climate/Maturity Groupings



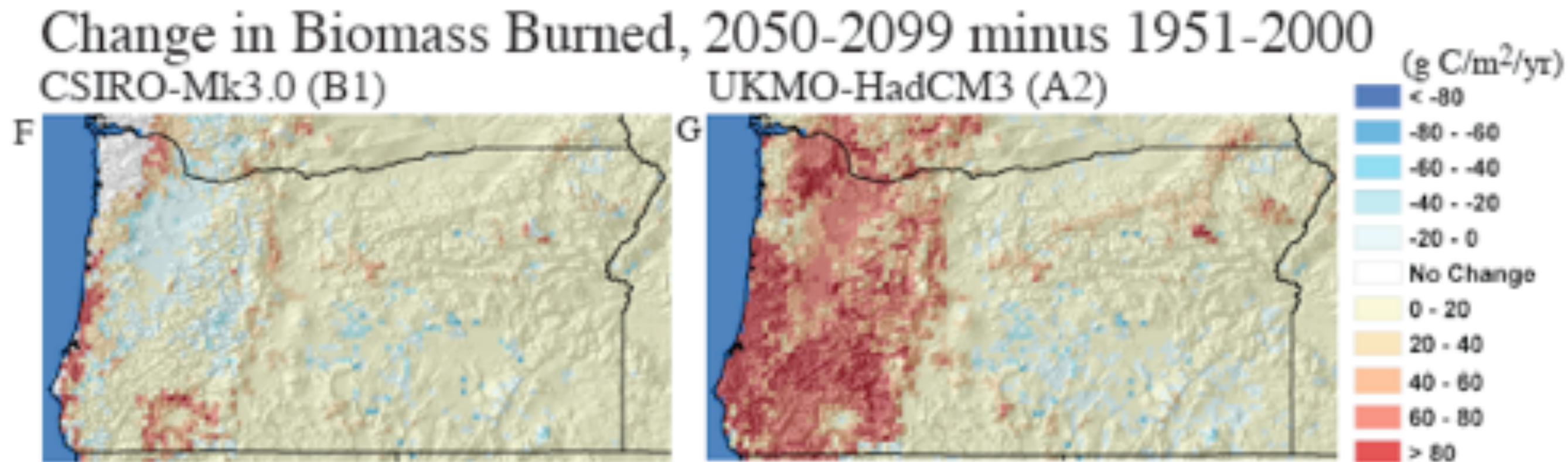
Jones et al. 2004

Ch. 5 Future Projections of Vegetation Type



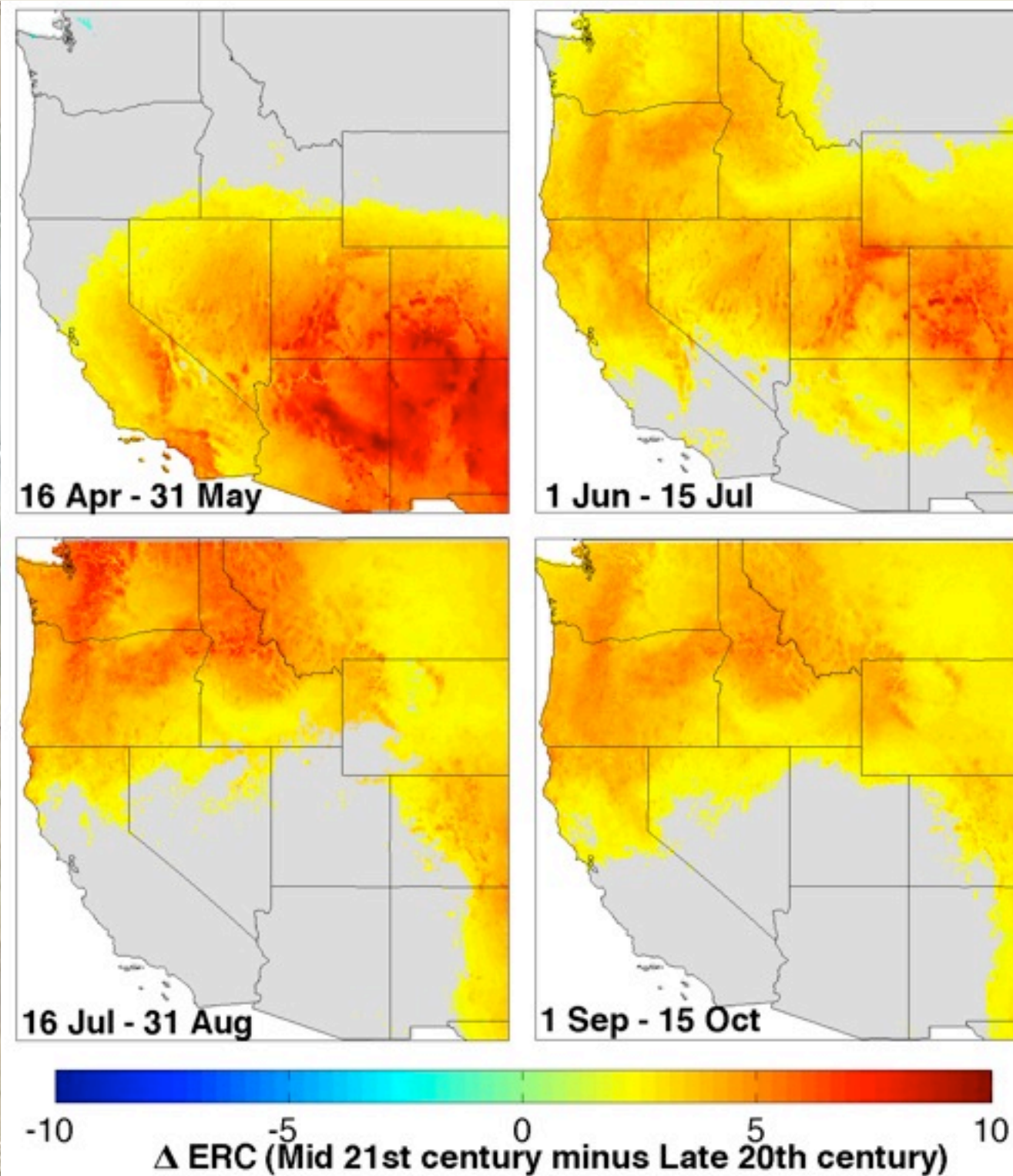
MAPSS, R. Neilson

changed in biomass burned



MAPSS, R. Neilson

Impacts: Increased Fire Potential

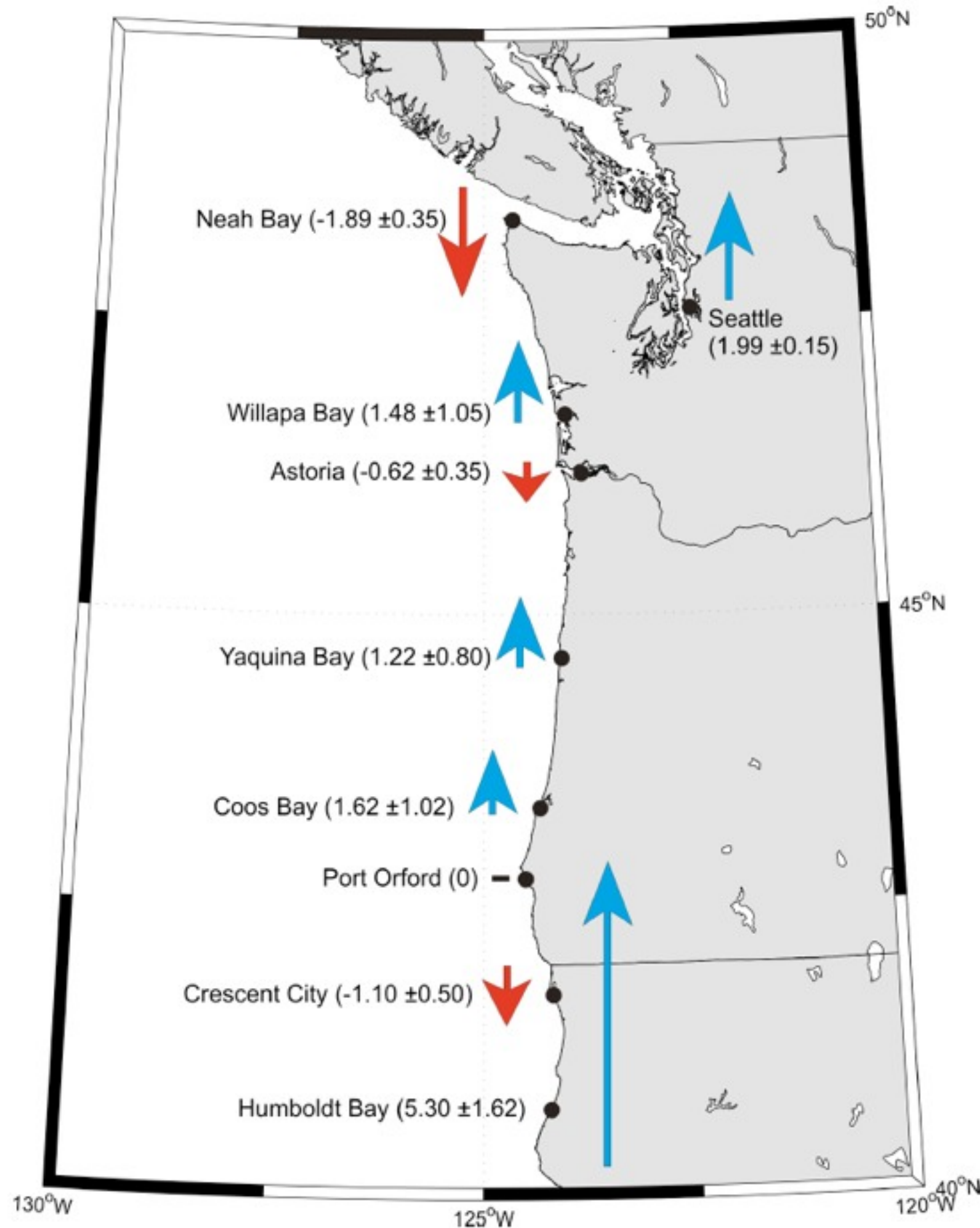


Sea Level Rise

Estimated global mean sea level rise over the 20th century: ~1.7 mm/year
(Holgate, 2007)

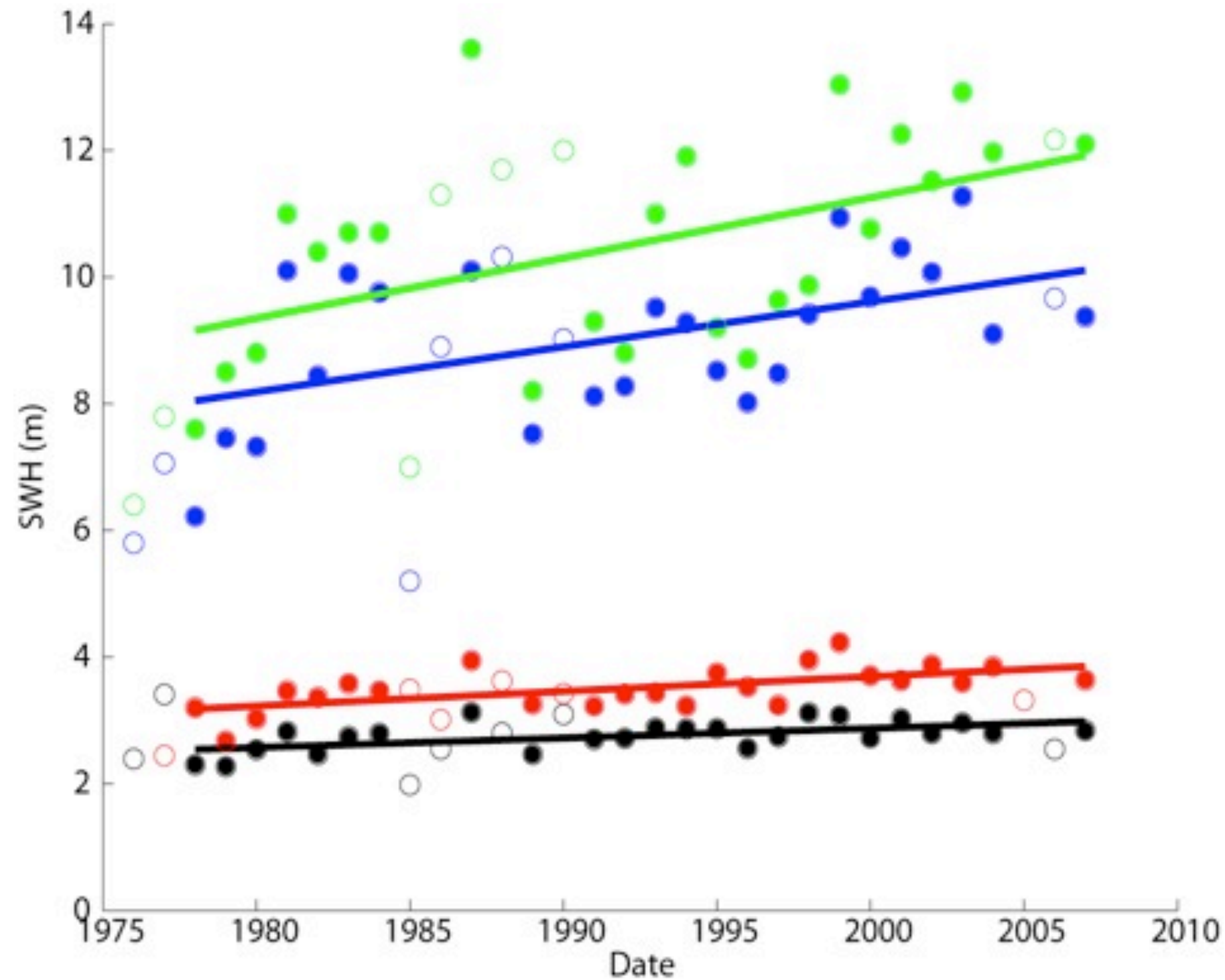
PNW eustatic sea level rise: ~2.33 mm/year since mid-century
(Burgette et al, 2009)

Local sea level change depends on local tectonic land



Courtesy NOAA

Increasing significant wave heights



after Ruggiero et al. 2010 30

Ch. 6

Shoreline retreat and armoring, Rockaway



photo: Don Best

Ocean acidification and the Pacific NW

- Regions of the west coast, including Oregon, have recently been found to be particularly susceptible to OA, due to the upwelling of deep waters having high carbon dioxide content and low pH (Feely et al., 2008; Hauri et al., 2009).
- a recent survey of waters along the coast of Oregon and northern California revealed that seawater acidity and levels of aragonite saturation (a measure of the ability of calcifying organisms to precipitate carbonate-based hard parts such as shells) are already at levels not forecast for another 150 yr for the ocean in general (Feely et al., 2008).
- Rykaczewski and Dunne (2010) note that the Pacific coast between British Columbia and northern California is particularly productive and retentive of organic material when compared with other regions of the California Current System, and conclude that this area will be impacted earlier and more intensely than other North American coastal regions by ocean acidification.

Ocean temperatures, PNW coast

- avg SST in near coastal environments varies by about 8°C seasonally (Mote and Salathé, 2010)
- changes in upwelling could cause more dramatic temperature shifts
- higher ocean temps overall may result in species shifts to the north
- Ocean heat content and average sea surface temperatures have been increasing on a global-ocean scale (Bindoff et al, 2007; Trenberth et al. 2007)
- Models predict PNW coastal SST to increase by 1.2 °C by the 2040s (Mote and Salathé, 2010)

Hypoxic events/algal blooms

- **likelihood: medium (upwelling intensification) / high (reduction of deep oxygen levels) / medium (algal blooms)**
- hypoxic conditions appear to be increasing in intensity, duration and spatial scale off the OR/WA coast
 - unclear if this will continue to intensify
- algal bloom events are on rise globally and appear to be increasing in OR nearshore waters
 - lack of long term dataset makes hard to tie to climate change
- source: Hixon et al 2010, Oregon Framework

observed species changes

- Could be natural variability or climate change
 - insects moving in from south of Oregon
 - frogs reproducing earlier in the year
 - land birds are shifting their distributions northward
 - freshwater fish losing habitats
 - humboldt squid appearing off OR coast

key findings

- increases in annual temperature, warmer drier summers
- summer water supply will decrease
 - reduced snowpack, drier summers
- Oregon's most ghg intensive sector is transportation
- availability, quality and cost of water will be a limiting factor

key findings

- potential opportunities in the ag sector
- wildfire is projected to increase
- frequency and magnitude of coastal flooding events may increase
- many plant and animal species on land, freshwater and sea will shift their distributions
- changes to the marine environment: both chemistry and temperature

Lots of Sun is Fun, But Where's the Snow?

Central Oregonians Enjoy Unusually Clear December

By Shanna Mendiola, KTVZ.COM

POSTED: 5:42 pm PST December 9, 2011

UPDATED: 6:07 pm PST December 9, 2011

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BEND, Ore. -- Plenty of sun and blue skies, but no snow? It hasn't been your typical snow- (or even rain-) laden winter wonderland lately on the High Desert, but the lack of powder isn't bringing everyone down.

Mt. Bachelor celebrates, then rues, massive snowfall that temporarily shut down resort

Published: Friday, January 20, 2012, 5:16 PM Updated: Friday, January 20, 2012, 5:18 PM



By Helen Jung, The Oregonian

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For a ski resort desperate for snow, a winter-storm dumping of six feet of snow would seem like a blessing.

But at this point, the people at **Mt. Bachelor in Bend** might be justified in feeling a little cursed.

High winds and extreme weather that brought the massive snowfall -- 74 inches in 72 hours -- left the ski resort with no power and forced it to stay closed on Thursday.

U.S. Drought Monitor

West

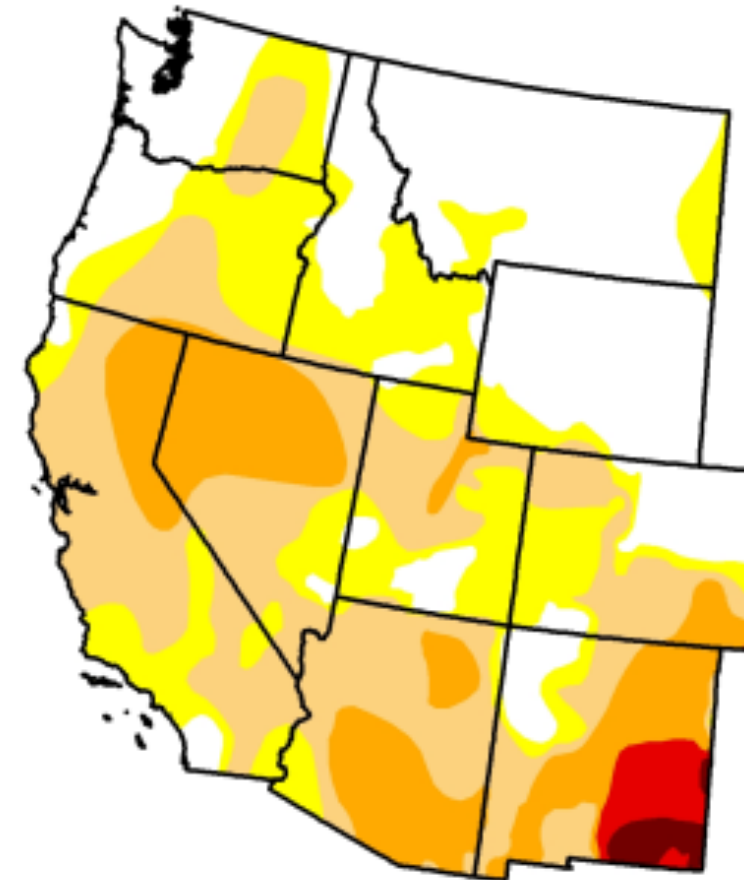
February 28, 2012

Valid 7 a.m. EST

	Drought Conditions (Percent Area)					
	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	31.91	68.09	45.30	17.63	2.56	0.83
Last Week (02/21/2012 map)	32.32	67.68	42.87	11.59	2.56	0.83
3 Months Ago (11/29/2011 map)	72.29	27.71	18.55	14.99	9.48	1.96
Start of Calendar Year (12/27/2011 map)	48.49	51.51	20.05	12.22	2.67	0.78
Start of Water Year (09/27/2011 map)	66.72	33.28	19.04	14.99	9.30	3.81
One Year Ago (02/22/2011 map)	76.19	23.81	15.02	5.41	0.00	0.00

Intensity:

 D0 Abnormally Dry	 D3 Drought - Extreme
 D1 Drought - Moderate	 D4 Drought - Exceptional
 D2 Drought - Severe	



The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

<http://droughtmonitor.unl.edu>

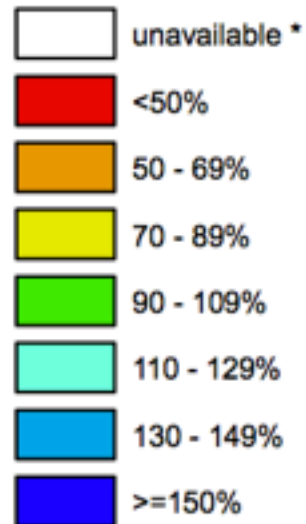


Released Thursday, March 1, 2012
Mark Svoboda, National Drought Mitigation Center

Oregon SNOTEL Current Snow Water Equivalent (SWE) % of Normal

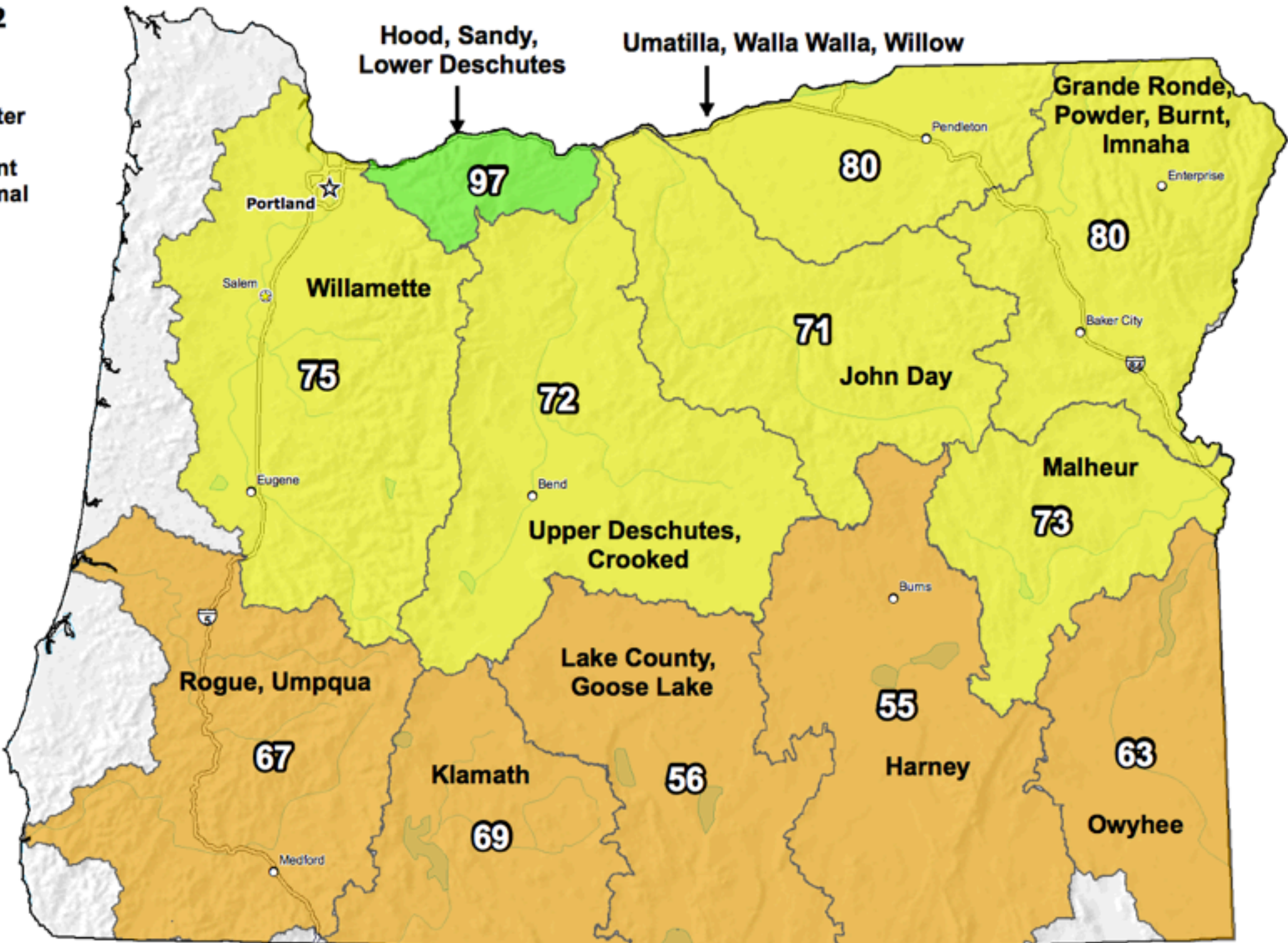
Mar 04, 2012

Current Snow Water Equivalent (SWE) Basin-wide Percent of 1971-2000 Normal



* Data unavailable at time of posting or measurement is not representative at this time of year

Provisional Data
Subject to Revision



The snow water equivalent percent of normal represents the current snow water equivalent found at selected SNOTEL sites in or near the basin compared to the average value for those sites on this day. Data based on the first reading of the day (typically 00:00).

0 10 20 40 60 80 100 Miles

Prepared by the USDA/NRCS National Water and Climate Center
Portland, Oregon <http://www.wcc.nrcs.usda.gov/gis/>
Based on data from <http://www.wcc.nrcs.usda.gov/reports/>
Science contact: Jim.Marron@por.usda.gov 503 414 3047

thank you!

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